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MX SITING INVESTIGATION SUMMARY OF SUITABLE AREA, NEVADA-UTAH. --ETC(U)

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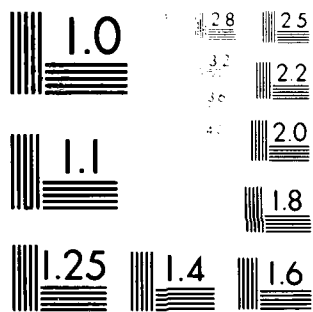
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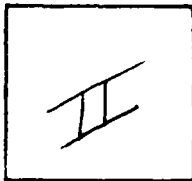


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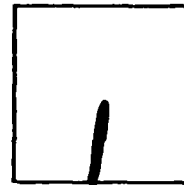
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MX SITING INVESTIGATION
SUMMARY OF SUITABLE AREA
NEVADA-UTAH
VERIFICATION STUDIES, FY 79 AND FY 80
VOLUME I

Prepared for:

U.S. Department of the Air Force
Ballistic Missile Office (BMO)
Norton Air Force Base, California 92409

Prepared by:

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2 July 1980

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20. ABSTRACT (Continue on reverse side if necessary and identify by block number) The verification studies in this report verify suitability of the area for the MX system. The studies are conducted suitable area maps for Englemann, Whipple and Tule, and the Hanford and Spring valleys in Nevada and Utah.		

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FOREWORD

This report was prepared for the Department of the Air Force, Ballistic Missile Organization (BMO), in compliance with Contract No. F04704-80-C-0006, CDRL Item 004A2. It summarizes the results of an evaluation of the suitability of portions of Nevada and Utah for siting the MX Land Mobile Advanced ICBM system.

The valleys covered in this report constitute the area of Verification studies during fourth quarter FY 79 and first half FY 80. The objective of the Verification studies is to verify the suitability of sufficient area for deployment of the MX system. The Verification studies are the final phase of a site-selection process which was begun in 1977. Previous phases have been termed Screening, Characterization, and Ranking. In preparing this report, it has been assumed that the reader is familiar with these previous studies.

An important result of the Verification studies is the delineation of suitable area in the subject valleys. It is the purpose of this report to present the derivative maps of suitable area. The basic data, and intermediate-step interpretive maps on which the suitable area maps are based, will be the subjects of subsequent reports, along with preliminary assessments of physical and engineering characteristics of the valley soils.

This report consists of two volumes:

Volume I - Contains sections 1.0, 2.0, and 3.0; Introduction, Methodology, and Results. Volume I also contains composite suitable area maps for all or portions of six valleys: Dugway, Whirlwind, Tule, Snake, Hamlin, and Spring valleys. This volume is presented herein.

Volume II - Contains composite suitable area maps for all or portions of eight valleys: Cave, Muleshoe, Delamar, Pahroc, Dry Lake, Garden, Coal, and White River valleys.

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1.0 INTRODUCTION

1.1 PURPOSE AND BACKGROUND

This report summarizes the results of the geotechnical Verification investigation which was conducted during the fourth quarter of FY 79 and the first and second quarters of FY 80 in portions of Nevada and Utah (Drawing 1-1). The purpose of these studies was to provide continuing technical information and recommendations to the USAF for its use in site selection and deployment decisions for the MX advanced ICBM program.

The present Verification studies are the final stage in the site selection process which began in FY 77 with geotechnical screening of the conterminous United States. Geotechnical Screening was followed by Characterization and Geotechnical Ranking studies. The overall phasing of these programs and a brief description of each are provided in Table 1-1.

The intent of the Verification phase is to refine and improve confidence levels in the boundaries of suitable areas that were determined from the previous site selection programs. In contrast to these previous programs that were based primarily on published information, the Verification studies are based on field investigations. Verification studies have concentrated on refining the boundaries of the suitable area and obtaining geotechnical data for preliminary engineering design use prior to site-specific studies. The design and scope of Verification studies are based on the results of Geotechnical Ranking which pointed out those geotechnical related factors that have the

CY 1977	CY 1978	CY 1979	CY 1980
[REDACTED] Coarse Screening, FN-TR-16*			
[REDACTED] Intermediate Screening, FN-TR-17			
[REDACTED] Fine Screening, FN-TR-24			
[REDACTED] Characterization, FN-TR-26			
[REDACTED] ■ ■ ■ Ranking, FN-TR-25			
VERIFICATION STUDIES [REDACTED] ■ ■ ■			
(* Number refers to Fugro National Technical Report Series.)			

SCREENING: Nationwide literature and map studies to identify potentially suitable areas based on a set of geotechnical, cultural, and environmental criteria. The study was conducted in three phases: Coarse, Intermediate, and Fine. At the completion of the Fine Screening studies, approximately 74,000 mi² (192,000 km²) had been identified as potentially suitable in 11 states in the western United States.

CHARACTERIZATION: Field studies in representative areas, in combination with more detailed literature and map studies, to better define the geotechnical conditions and refine boundaries of suitable areas that had been identified during the Screening studies.

GEOTECHNICAL RANKING: A comparison of seven Candidate Siting Regions, based on the relative cost of geotechnically related construction items. The rankings were performed for the hybrid trench, vertical shelter, and horizontal shelter MX basing modes.

**PHASING OF PROGRAMS AND
DESCRIPTION OF PREVIOUS PROGRAMS**

MX SITING INVESTIGATION
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TABLE
1-1

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greatest influence on construction costs. Verification studies in the Nevada-Utah siting region have been ongoing since the end of FY 78, and are expected to extend into FY 81. Because of the length of the program, an initial Verification Report, covering portions of eight valleys was issued in August 1979 (FN-TR-27). The areas covered by this prior report are shown on Drawing 1-1.

1.2 FY 79 - FY 80 VERIFICATION AND DATA GAP STUDIES

Evaluation of data from the FY 79 Verification sites resulted in a recommendation to conduct limited additional field studies in some of the valleys to determine more precisely the extent of major rock and ground-water exclusions. These studies, named Data Gap studies, were conducted in the verified portions of Whirlwind, Snake, Hamlin, White River, Garden, and Coal valleys (Drawing 1-1).

Concurrent with the Data Gap studies, basic Verification studies were conducted in all or portions of Dugway, Tule, Spring, Cave, Delamar, Muleshoe, Dry Lake, and Pahroc valleys. Additionally, studies were continued in the unverified portions of Whirlwind, Snake, Garden, and Coal valleys (Drawing 1-1).

1.3 SCOPE

This report summarizes the results of the Verification studies from August 1979 to March 1980. Because of the necessity of continuing the field Verification studies in the remainder of the siting region, this report is limited to presenting the suitable area maps for the areas studied. The maps cover all or portions of the following valleys.

Dugway
Whirlwind
Tule
Snake
Hamlin
Spring

maps contained in this volume

Cave
Muleshoe
Delamar
Pahroc
Garden and Coal
White River
Dry Lake

maps contained in Volume II

Full verification reports on these valleys will be prepared in
FY 81.

The remainder of the this volume discusses the study methods
(Section 2.0), and results (Section 3.0).

2.0 STUDY METHODS

2.1 GENERAL

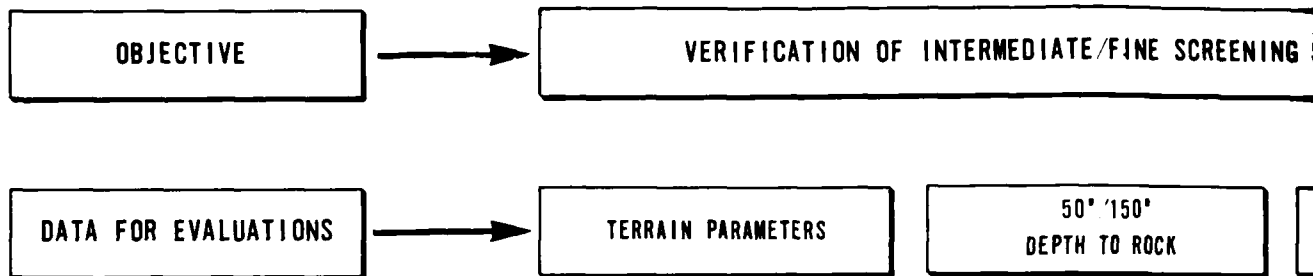
The suitable area identified during Screening was based primarily on available literature and very limited site-specific investigation. To verify that these areas are, in fact, suitable and to improve the boundaries between suitable and unsuitable areas, it was considered essential that actual conditions be determined from field studies.

Verification studies consist of a combination of geologic, geophysical, and soils engineering investigations designed to differentiate suitable and unsuitable area and to obtain basic information about the geotechnical characteristics of the basin-fill materials. The field program is shown schematically in Table 2-1. The parameters which are evaluated are shown as column headings and the applicable investigative techniques are listed below.

Table 2-2 lists the number of activities that have been performed in each verified area to date.

Field work was started in August 1979 and continued into December. During January, February and March 1980, when inclement weather existed in the study area, office studies (data reduction and analysis) were performed.

The reader must be aware of the limitations of the investigations to date and must recognize that additional revisions regarding the suitability of some areas will be required as the



FIELD TECHNIQUES AND APPLICATIONS

Geologic mapping

- Identification and limits of areas with slopes greater than 10% grade
- Identification and limits of areas with high incidence of 10% slopes (rolling terrain)

Geologic mapping

- Surface limits of rock
- Subsurface limits of rock from topographic and geologic interpretation
- Geomorphic expression and erosion history

Seismic refraction surveys

- Subsurface projection of rock limits
- Delineation of rock from high (>>7000 fps) p-wave velocities

Borings

- Occurrence of rock

Gravity profiles (DMA)

- Overall basin shape and relationships
- Range-bounding faults

Existing data

- Published literature

OF INTERMEDIATE/FINE SCREENING SUITABLE AREA

50' '150'
DEPTH TO ROCK

50' '150'
DEPTH TO GROUND WATER

Geologic mapping

- Surface limits of rock
- Subsurface limits of rock from topographic and geologic interpretation
- Geomorphic expression and erosion history

Seismic refraction surveys

- Subsurface projection of rock limits
- Delineation of rock from high ($\gg 7000$ fps) p-wave velocities

Borings

- Occurrence of rock

Gravity profiles (DMA)

- Overall basin shape and relationships
- Range-bounding faults

Existing data

- Published literature

Existing data

- Available well records and interpretation

Borings

- Occurrence of ground water

Electrical resistivity/ seismic refraction surveys

Provide supplemental data to support presence or absence of ground water

Geologic mapping

- Obtain water depths from wells encountered in field

FIELD TECHNIQUES VERIFICATION STUDIES

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMO

TABLE
2-1

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VALLEY	GEOLOGIC MAPPING STATIONS	SEISMIC REFRACTION	ELECTRICAL RESISTIVITY	BORINGS			TEST PITS	TRENCHES	CONE PENETROMETER TESTS
				SOIL	WITH OBS. WELLS	TOTAL			
DUGWAY	68	16	16	5	1	6	19	8	48
* WHIRLWIND	144 (0)	38 (10)	38 (10)	10 (0)	14 (11)	24 (11)	38 (0)	14 (0)	99 (0)
TULE	222	46	46	13	9	22	49	24	130
* SNAKE	80 (0)	30 (3)	29 (3)	11 (0)	7 (7)	18 (7)	38 (0)	10 (0)	100 (0)
SPRING	73	12	12	5	1	6	16	10	43
CAVE	58	8	8	4	1	5	9	7	20
MULESHOE	48	6	6	3	0	3	9	8	24
DELAMAR	79	15	15	5	0	5	18	10	44
PAHROC	49	5	6	3	0	3	8	6	21
DRY LAKE	60	17	0	18	0	18	29	18	84
* GARDEN	45 (0)	16 (0)	16 (0)	6 (0)	8 (7)	14 (7)	25 (0)	9 (0)	43 (0)
* COAL	84 (0)	11 (0)	11 (0)	5 (0)	2 (2)	7 (2)	21 (0)	14 (0)	62 (0)
* HAMLIN	42 (0)	24 (5)	24 (5)	6 (0)	5 (5)	11 (5)	28 (0)	11 (0)	61 (0)
* WHITE RIVER	54 (0)	21 (2)	25 (2)	7 (0)	4 (4)	11 (4)	22 (0)	8 (0)	54 (0)

* DATA GAP VALLEY; NUMBER WITHOUT PARENTHESES INDICATES TOTAL NUMBER OF ACTIVITIES IN THIS VALLEY AS OF MARCH 1980; NUMBER WITH PARENTHESES INDICATES ACTIVITIES COMPLETED FOR DATA GAP STUDIES.

GEOTECHNICAL ACTIVITIES
VERIFICATION STUDIES
NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - DMO

TABLE
2-2

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studies continue. The suitable area reported here is based on two different levels of investigation. A higher level of confidence is associated with the Data Gap sites because the most recent studies performed in these areas resolved specific geotechnical questions remaining from prior Verification studies and supplemented the Verification study data base. The areas covered only by Verification studies, on the other hand, may have local ambiguities which need to be resolved by additional geotechnical studies (i.e., Data Gap studies in FY 80).

2.2 ANALYSIS OF SUITABLE AREA

The interpretations of suitable area are derived from three sources as explained in the following sections. Each of these sources is compiled on a separate overlay map, and the overlays are combined to determine the suitable area.

2.2.1 Depth to Rock

In all the Verification study areas, the locations of 50- and 150-foot depth to rock contours were estimated based on limited boring and geophysical data in combination with geologic interpretation. The interpretation considers the presence or absence of range-bounding faults, bedding plane attitudes, evidence of erosional features such as pediments, topographic slope, and the presence or absence of young volcanic rocks.

2.2.2 Depth to Water

The locations of 50- and 150-foot depth to ground-water contours have been estimated for all Verification study areas interpreted to contain shallow ground water. The reliability

of the interpretations is highly variable, depending on the source of available data. In some of these areas, refinements in contour locations were made using additional water well, boring or geophysical data. Such refinements were limited and it can be expected that suitable area boundaries will change as new data are collected.

2.2.3 Terrain

During Screening studies, areas were excluded on the basis of two criteria: percent grade and relative relief. The major exclusion criterion was a maximum permissible grade of ten percent as measured from 1:250,000 scale topographic maps. Any area with a surface slope exceeding ten percent was excluded. Relative relief exclusions were twofold: 1) areas of characteristic terrain defined by a preponderance of slopes exceeding five percent as determined from maps at scales of 1:250,000, 1:62,500, and 1:24,000; and 2) areas having drainage densities averaging at least two 10-foot drainages per 1000 feet, as determined from maps at a scale of 1:24,000. In many of the areas studied during Verification, detailed topographic maps have not been made and the available maps have contour intervals of 20 feet (6 m) or more. Such maps do not show topographic conditions with sufficient detail to make an accurate evaluation of terrain suitability.

3.0 RESULTS

3.1 SUITABLE AREA

Tables 3-1A and 3-1B present a listing of suitable area based on the results of the FY 79 - FY 80 Verification and Data Gap studies. The suitable area interpretations were compiled on maps at a scale of 1:125,000 (Drawings 3-1 to 3-6 in Volume I and 3-7 to 3-14 in Volume II). The suitable area boundaries were digitized and input to a computer program to calculate the area within the boundaries. Table 3-1A presents the FY 79 - FY 80 suitable area for the newly verified areas of 12 valleys. Table 3-1B presents the FY 79 - FY 80 suitable area resulting from the Data Gap studies in portions of six valleys which had been previously verified in FY 79 (FN-TR-27). Table 3-1C shows the estimated suitable area for three valleys which were previously reported (FN-TR-27) but were not the subject of Data Gap studies in FY 79 - FY 80. Thus, the totals of Tables 3-1A, 3-1B, and 3-1C reflect the verified suitable area in the Nevada-Utah siting region as of this report.

3.2 CHANGES IN SUITABLE AREA DUE TO DATA GAP STUDIES

At the start of the FY 79 - FY 80 field program a total of 1250 square miles in Whirlwind, Snake, Garden, Coal, Hamlin, and White River valleys had been verified as suitable for the horizontal basing mode. A total of 885 square miles in the same valleys was verified as suitable for the vertical basing mode. As a result of the FY 79 - FY 80 Data Gap studies, these figures are changed to 1225 square miles for the horizontal mode and

TABLE 3-1A

NEWLY VERIFIED AREA	STATE	FY 79-80 SUITABLE AREA [mi ² (km ²)]	
		HORIZONTAL MODE	VERTICAL MODE
1. DUGWAY	UTAH	165 (425)	135 (350)
2. WHIRLWIND	UTAH	105 (270)	60 (155)
3. TULE	UTAH	395 (1025)	215 (555)
4. SNAKE	NEVADA-UTAH	70 (180)	55 (140)
5. SPRING	NEVADA	120 (310)	60 (155)
6. CAVE	NEVADA	115 (300)	105 (270)
7. MULESHOE	NEVADA	65 (170)	55 (140)
8. DELAMAR	NEVADA	155 (400)	140 (360)
9. PAHROC	NEVADA	100 (260)	85 (220)
10. GARDEN	NEVADA	10 (25)	5 (15)
11. COAL	NEVADA	150 (390)	135 (350)
12. DRY LAKE	NEVADA	315 (815)	290 (750)
TOTAL TABLE 3-1A		1765 (4570)	1340 (3460)

TABLE 3-1B

DATA GAP AREA	STATE	FY 79-80 SUITABLE AREA [mi ² (km ²)]	
		HORIZONTAL MODE	VERTICAL MODE
1. WHIRLWIND	UTAH	265 (685)	235 (610)
2. SNAKE	NEVADA-UTAH	205 (530)	130 (335)
3. GARDEN	NEVADA	200 (520)	160 (415)
4. COAL	NEVADA	95 (245)	80 (205)
5. HAMLIN	NEVADA	255 (660)	160 (415)
6. WHITE RIVER	NEVADA	205 (530)	75 (195)
TOTAL TABLE 3-1B		1225 (3170)	840 (2175)

TABLE 3-1C			
PREVIOUSLY VERIFIED AREA	STATE	FY 79 SUITABLE AREA [mi ² (km ²)]	
		HORIZONTAL MODE	VERTICAL MODE
1. RAILROAD	NEVADA	290 (750)	155 (400)
2. RALSTON	NEVADA	225 (585)	195 (505)
3. BIG SMOKY	NEVADA	410 (1060)	155 (400)
TOTAL TABLE 3-1C		925 (2395)	505 (1305)

TOTAL TABLE 3-1A	1765 (4570)	1340 (3460)
TOTAL TABLE 3-1B	1225 (3170)	840 (2175)
TOTAL TABLE 3-1C	925 (2395)	505 (1305)
TOTAL VERIFICATION STUDIES FY 79 AND FY 79-80	3915 (10 135)	2685 (6940)

*SUITABLE AREA VALUES ARE ROUNDED-OFF TO NEAREST INCREMENT OF 5 SQUARE MILES OR 5 SQUARE KILOMETERS

ESTIMATED SUITABLE AREA
FY 79-FY 80 VERIFICATION STUDIES
NEVADA-UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE DMO

TABLE
3-1

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840 square miles for a vertical mode. The largest loss of suitable area occurred in White River Valley and was largely due to shallow ground-water. Two of the valleys (Snake and Hamlin) gained small amounts of suitable area because of the studies.

3.3 SUITABLE AREA MAPS

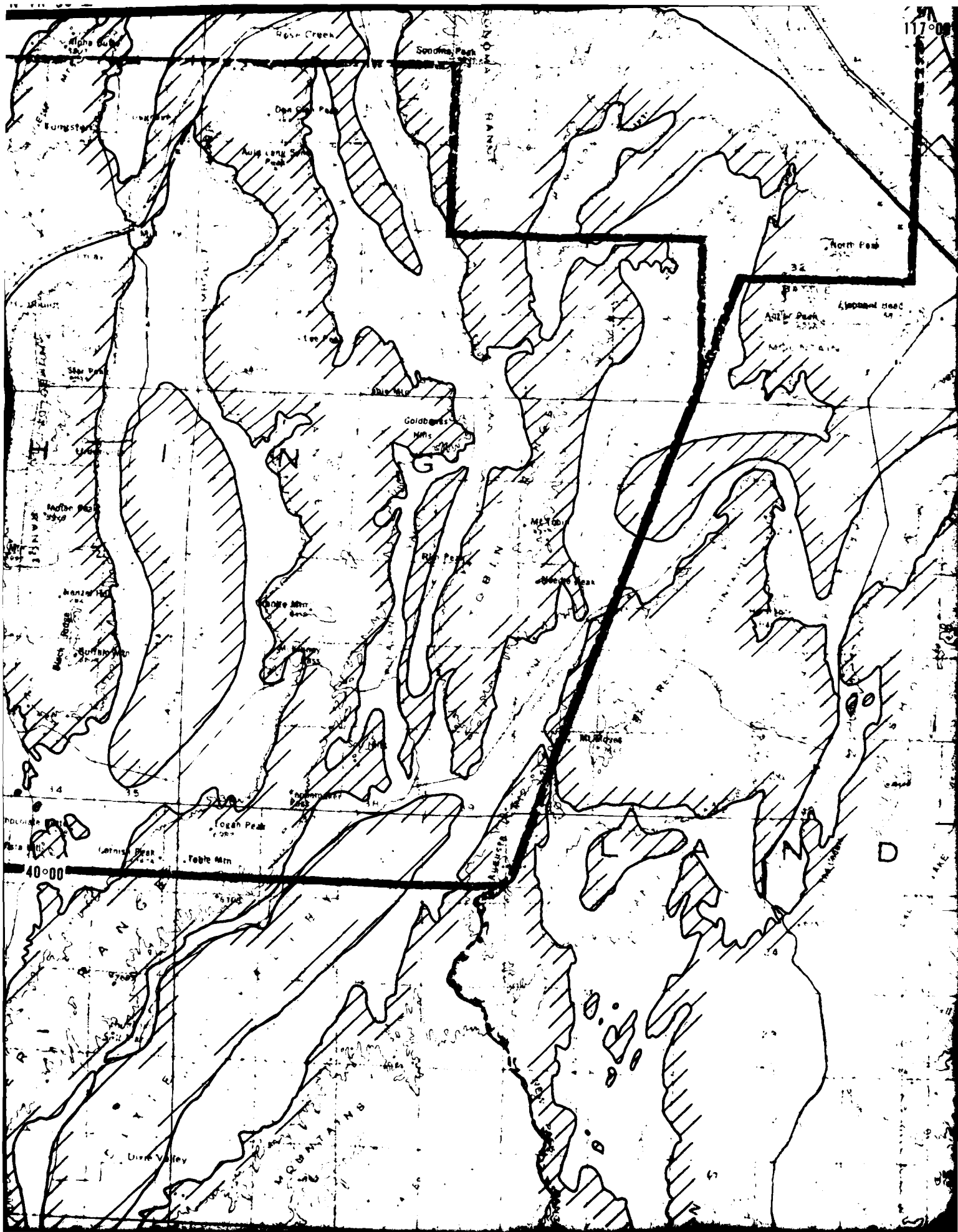
Maps of Suitable Area of the following valleys are presented in Volume I of the report:

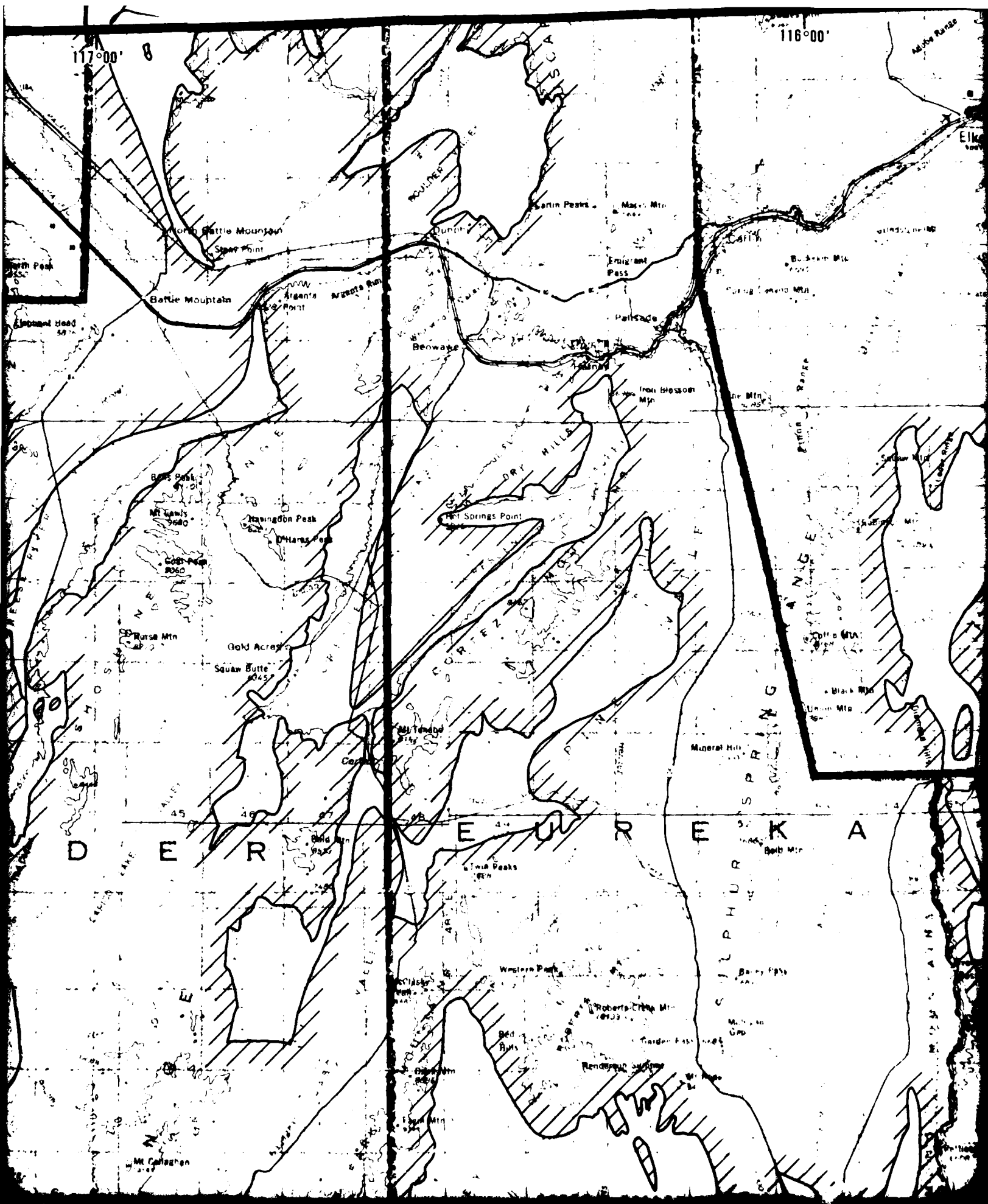
Dugway Valley	Drawing 3-1
Whirlwind Valley	Drawing 3-2
Cave Valley	Drawing 3-3
Snake Valley	Drawing 3-4
Hamlin Valley	Drawing 3-5
Spring Valley	Drawing 3-6

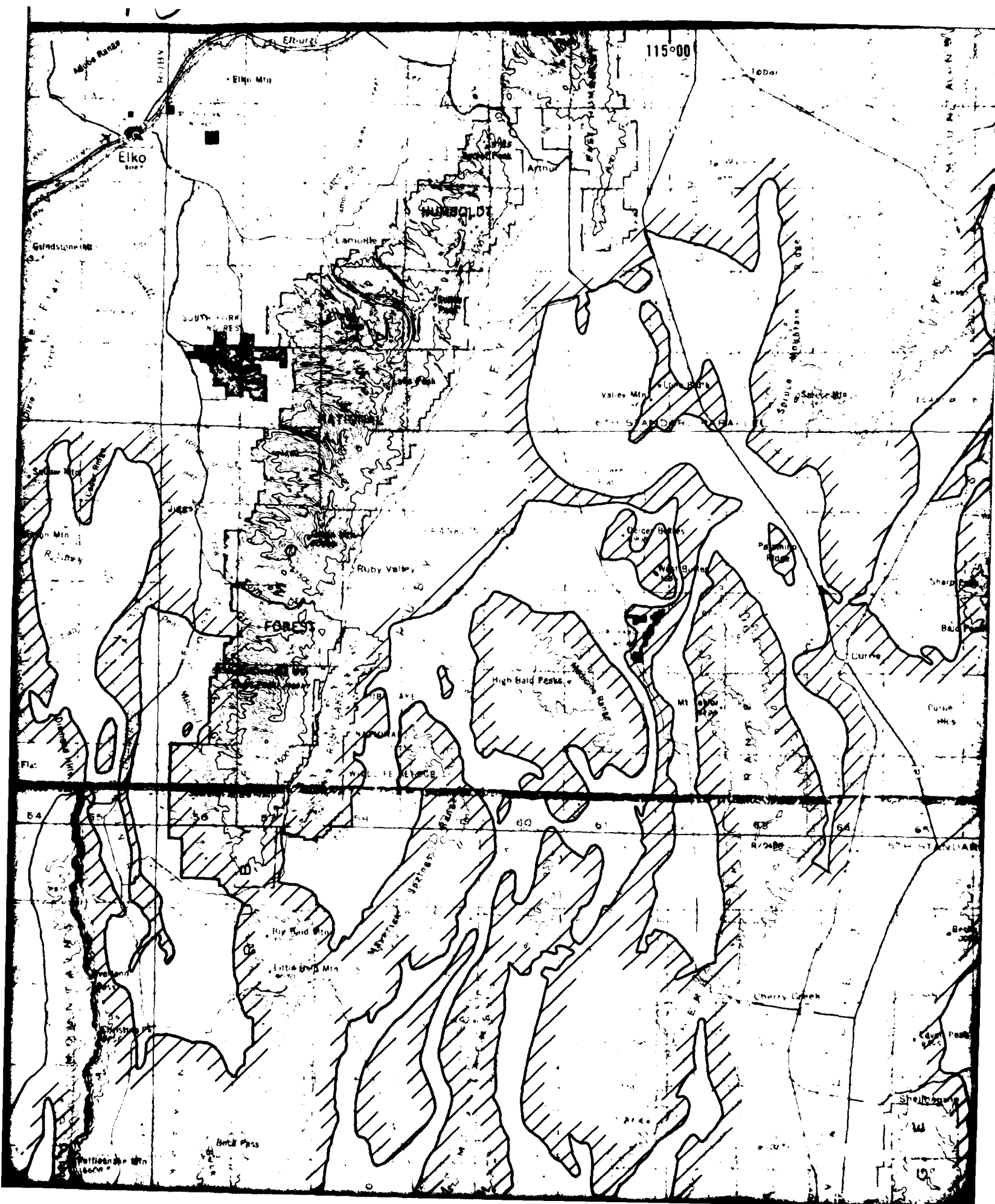
Suitable area maps of the following valleys are presented in

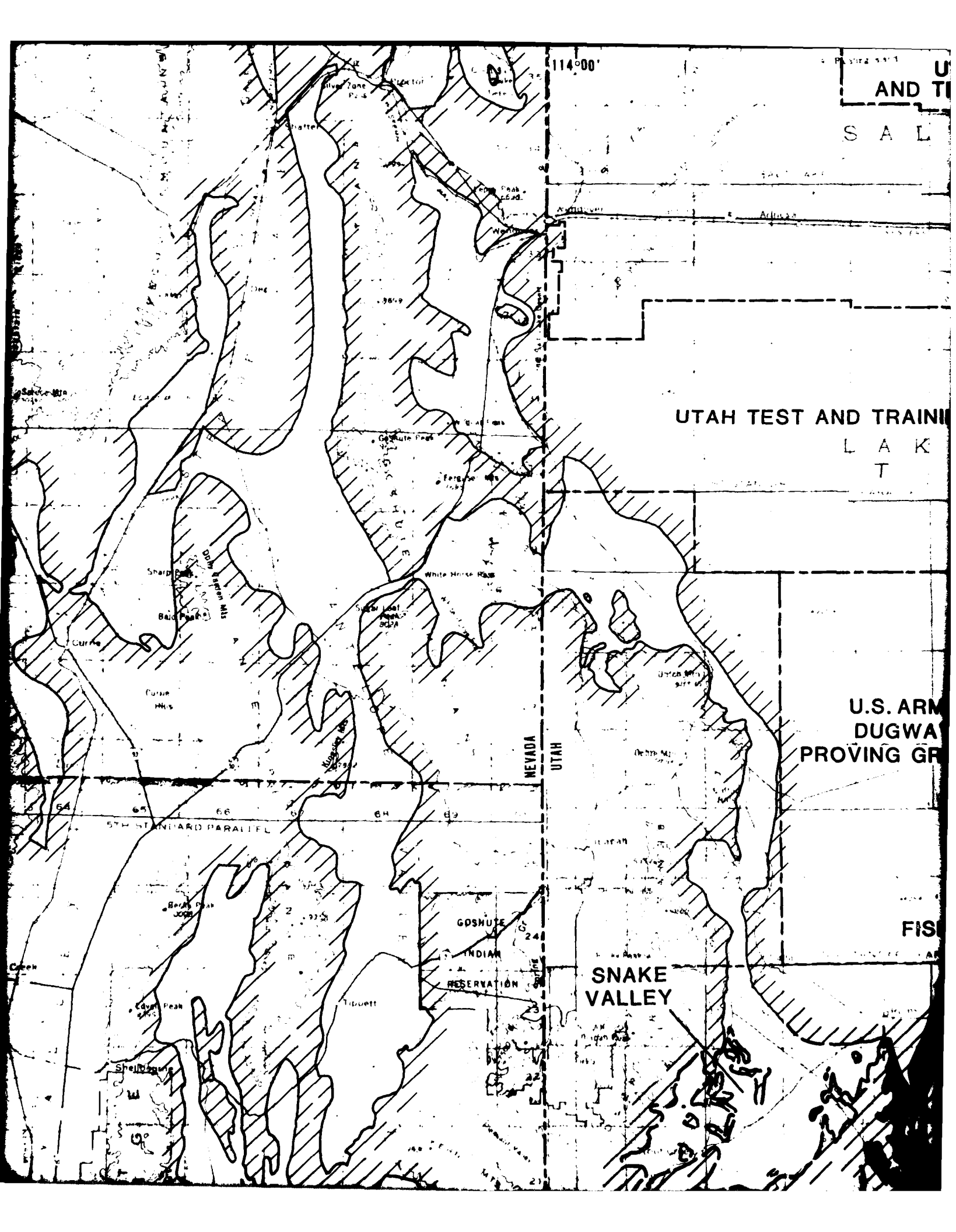
Volume II:

Cave Valley	Figure 3-7
Muleshoe Valley	Figure 3-8
Delamar Valley	Figure 3-9
Pahroc Valley	Figure 3-10
Dry Lake Valley	Figure 3-11
Garden and Coal Valleys	Figure 3-12
White River Valley	Figure 3-13









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S A L

UTAH TEST AND TRAINING
L A K
T

U.S. ARM
DUGWA
PROVING GR

FIS

NEVADA
UTAH

GOSHUTE
INDIAN
RESERVATION

Snake
VALLEY

5TH STANDARD PARALLEL

UTAH TEST
AND TRAINING RANGE

113°00'

S A L T

EST AND TRAINING RANGE

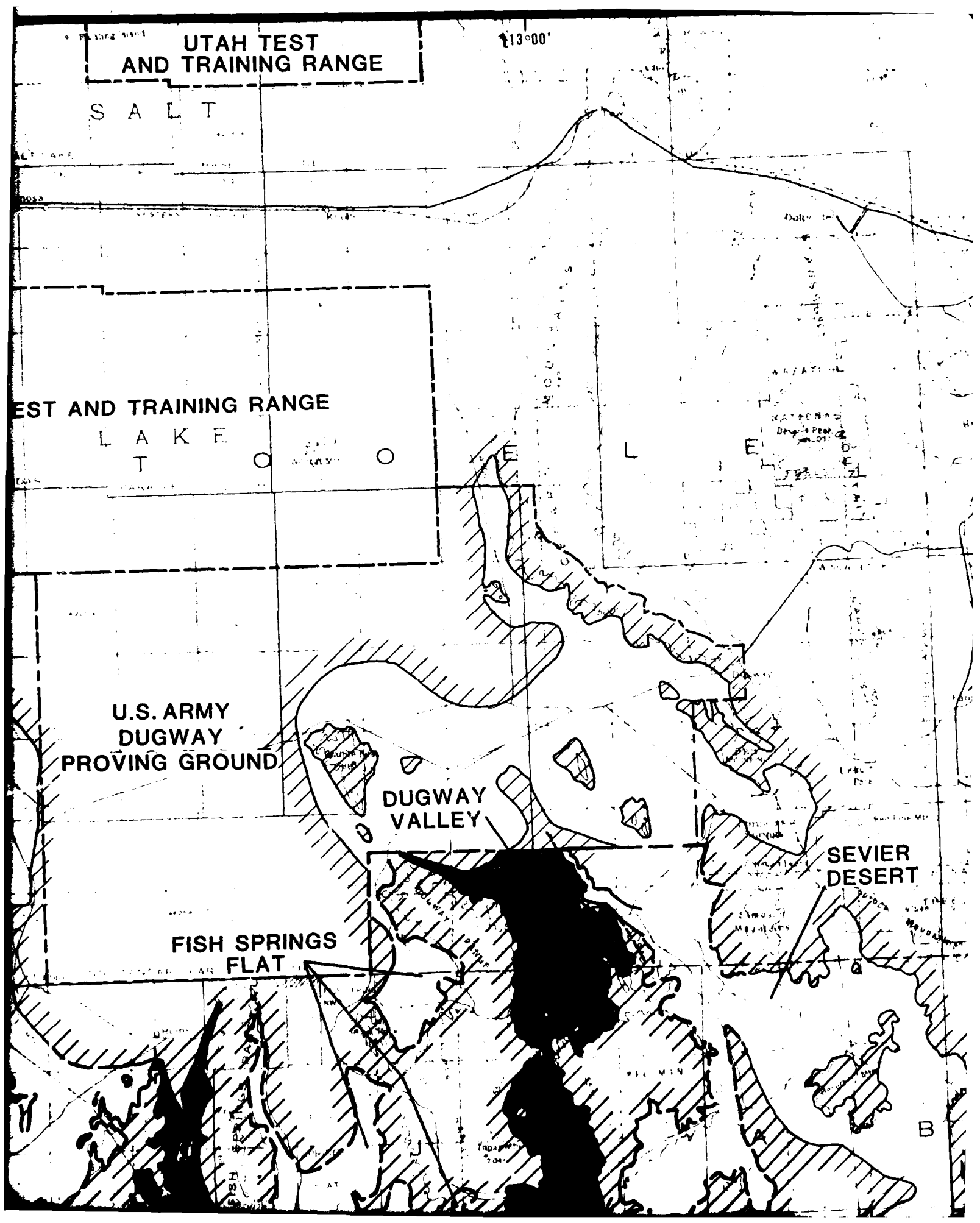
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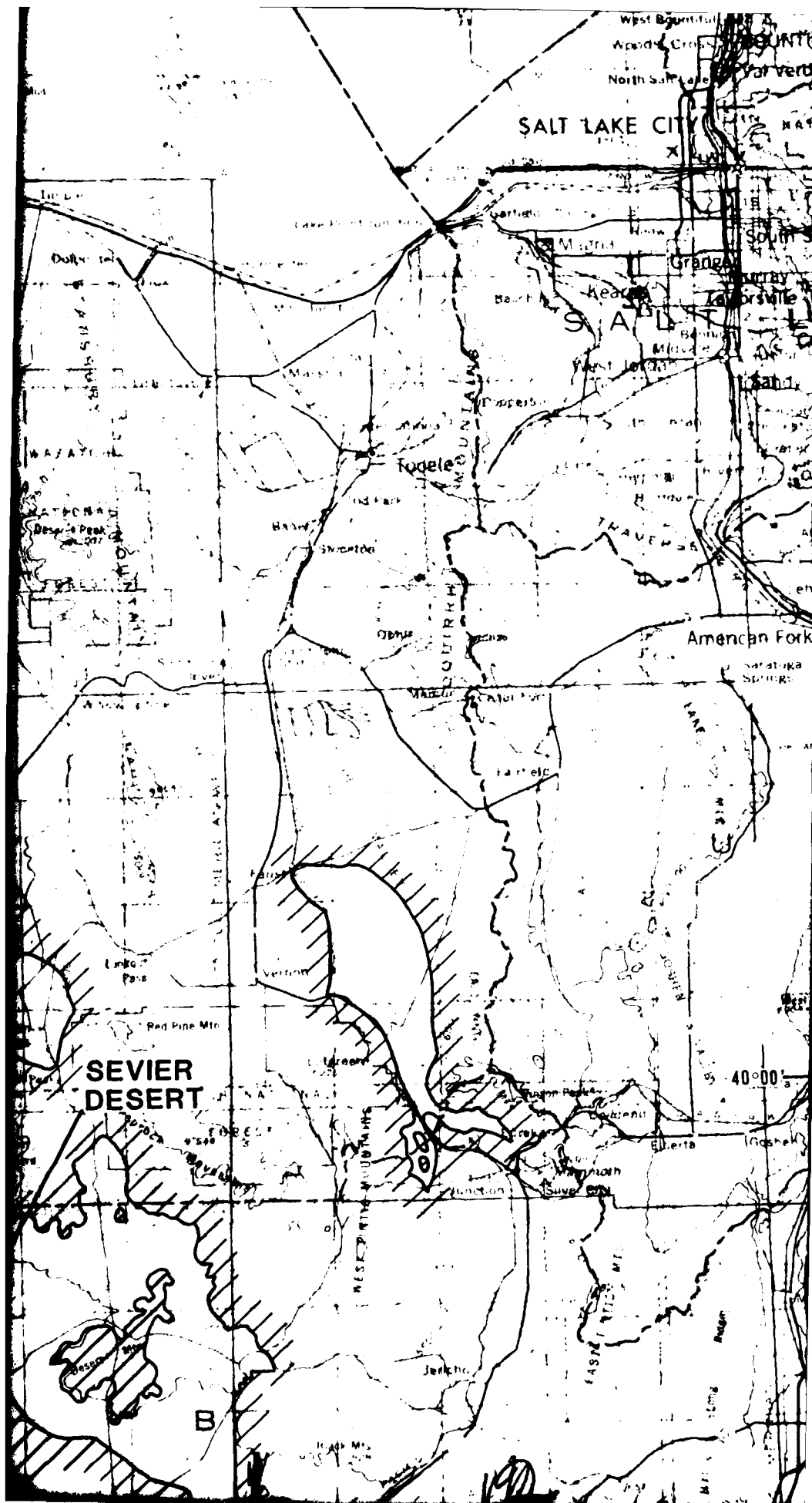
U.S. ARMY
DUGWAY
PROVING GROUND

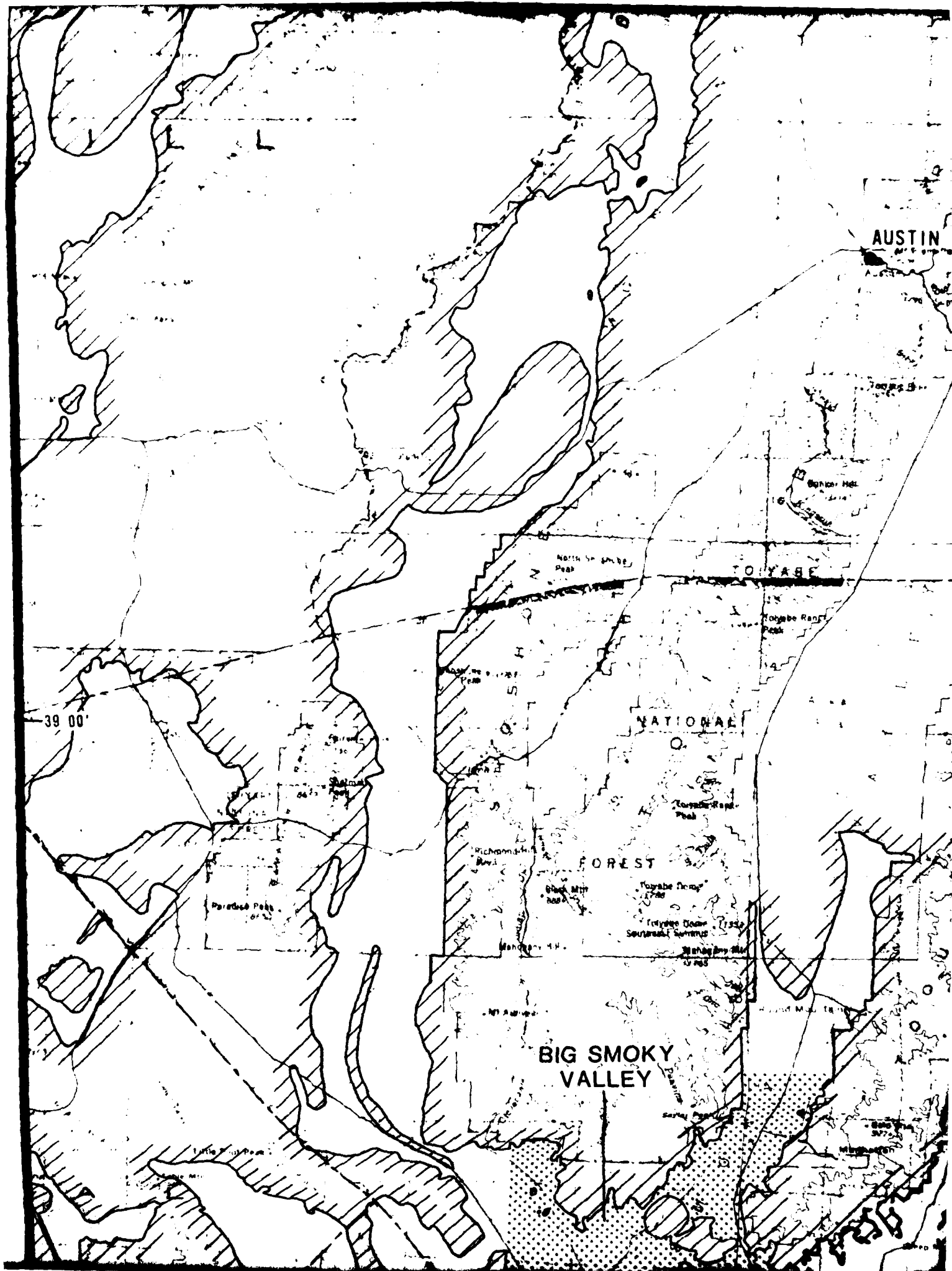
DUGWAY
VALLEY

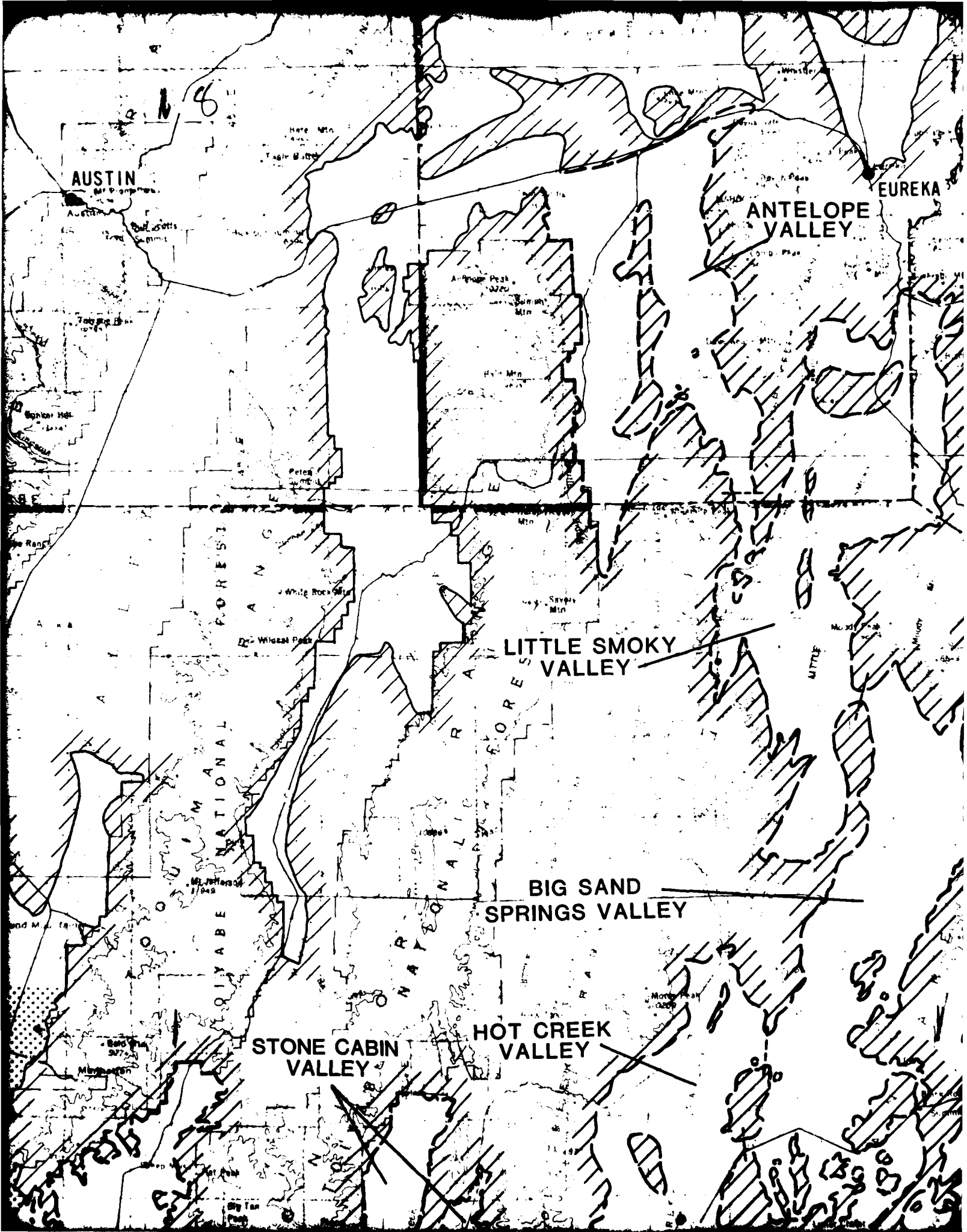
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FLAT

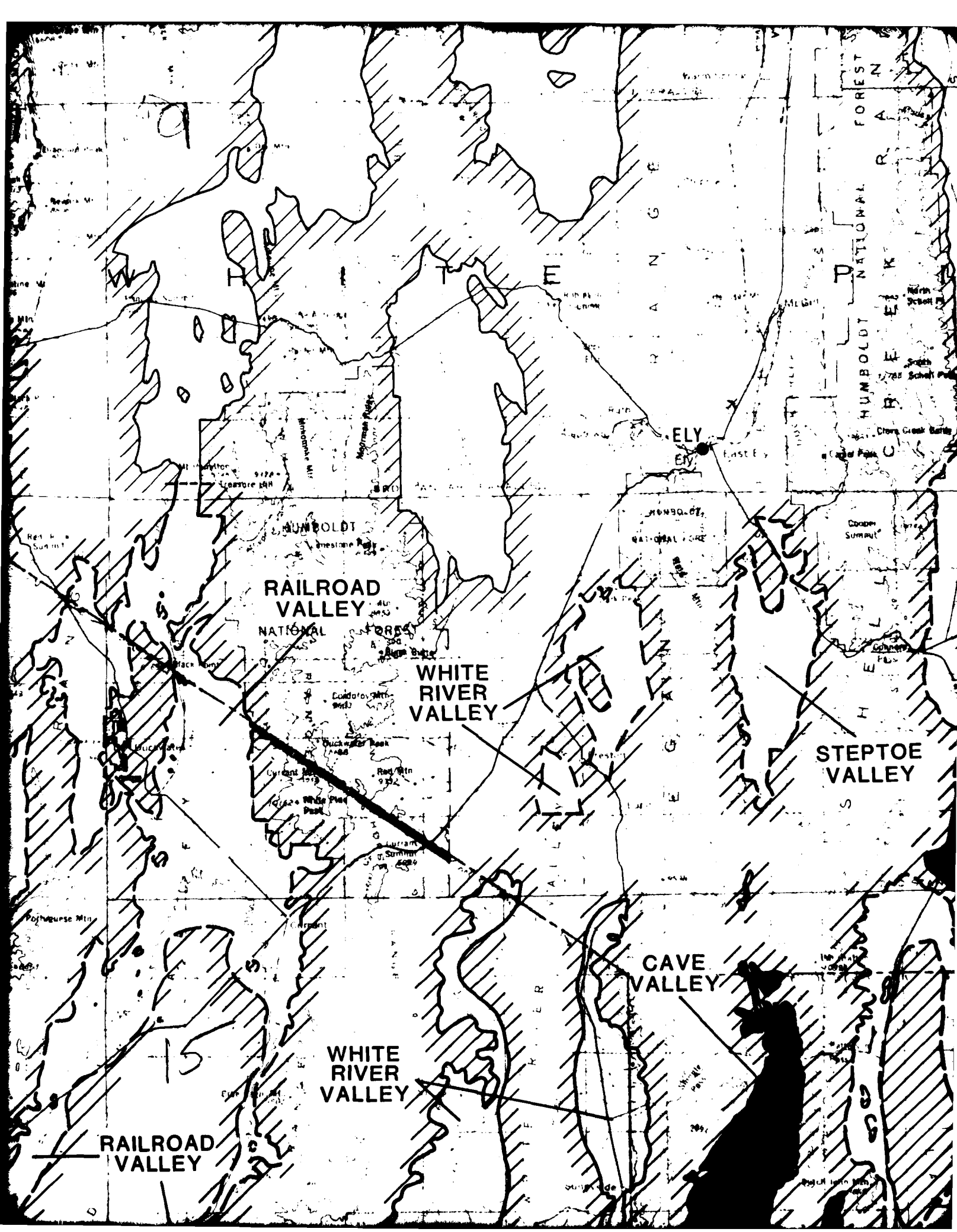
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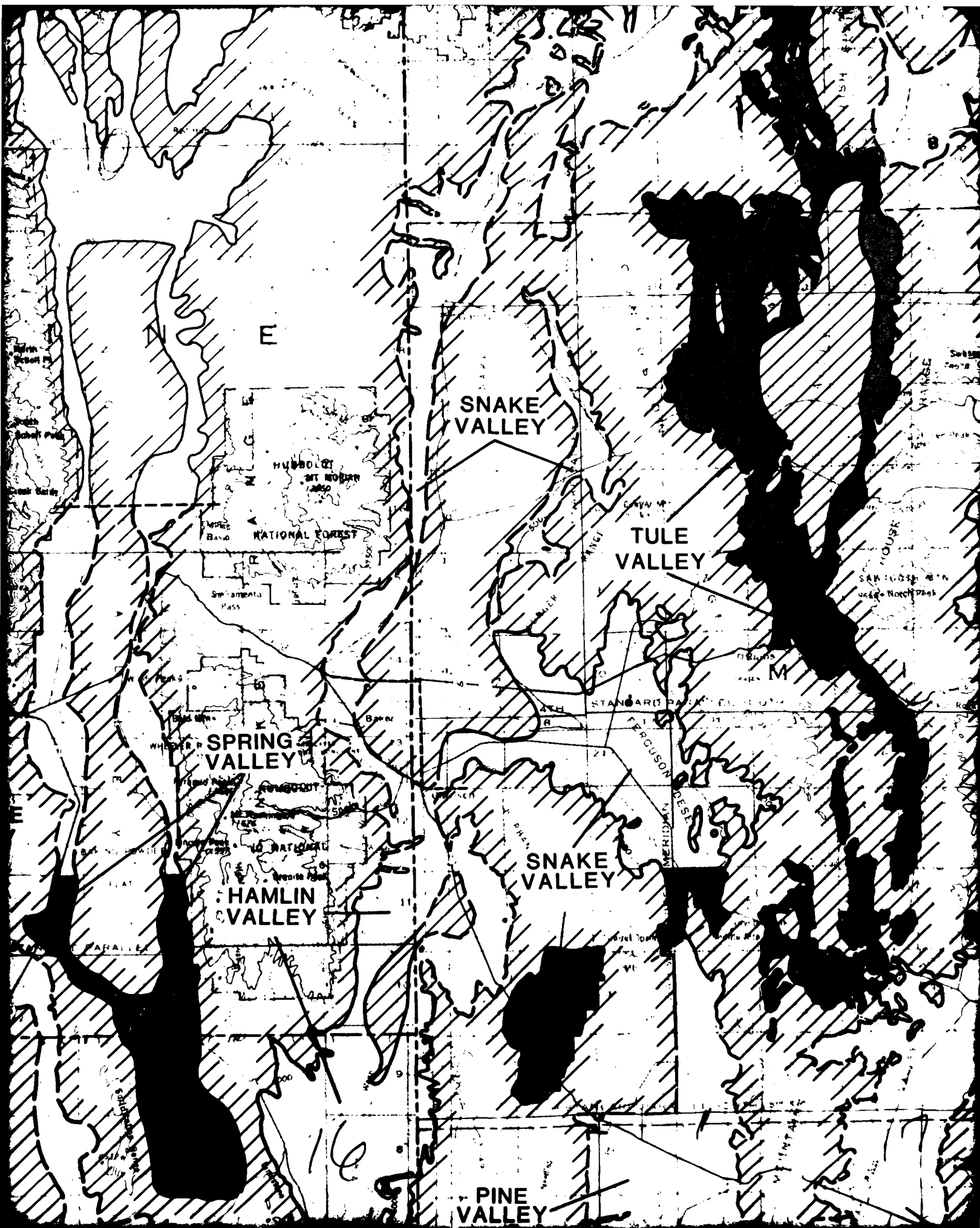


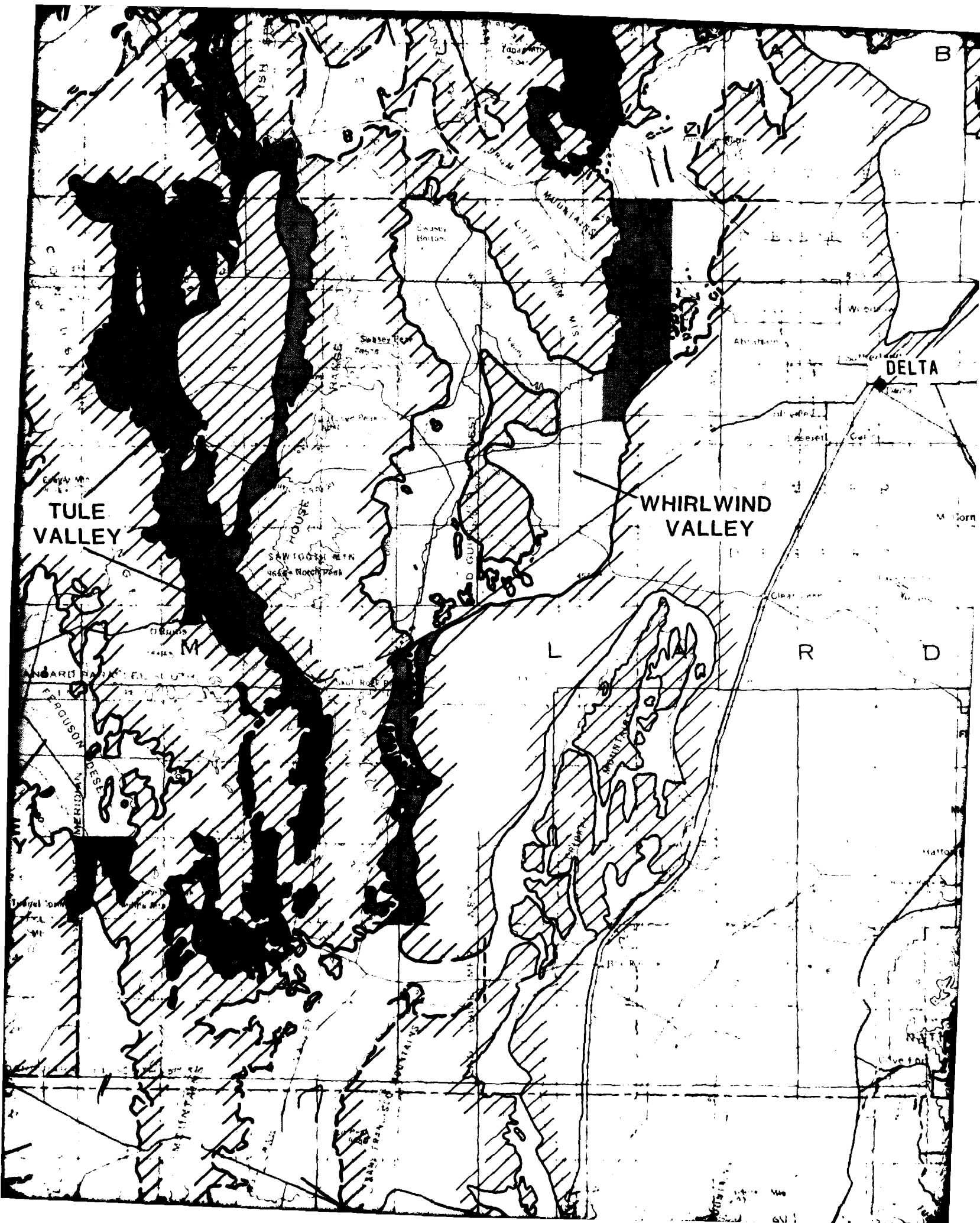


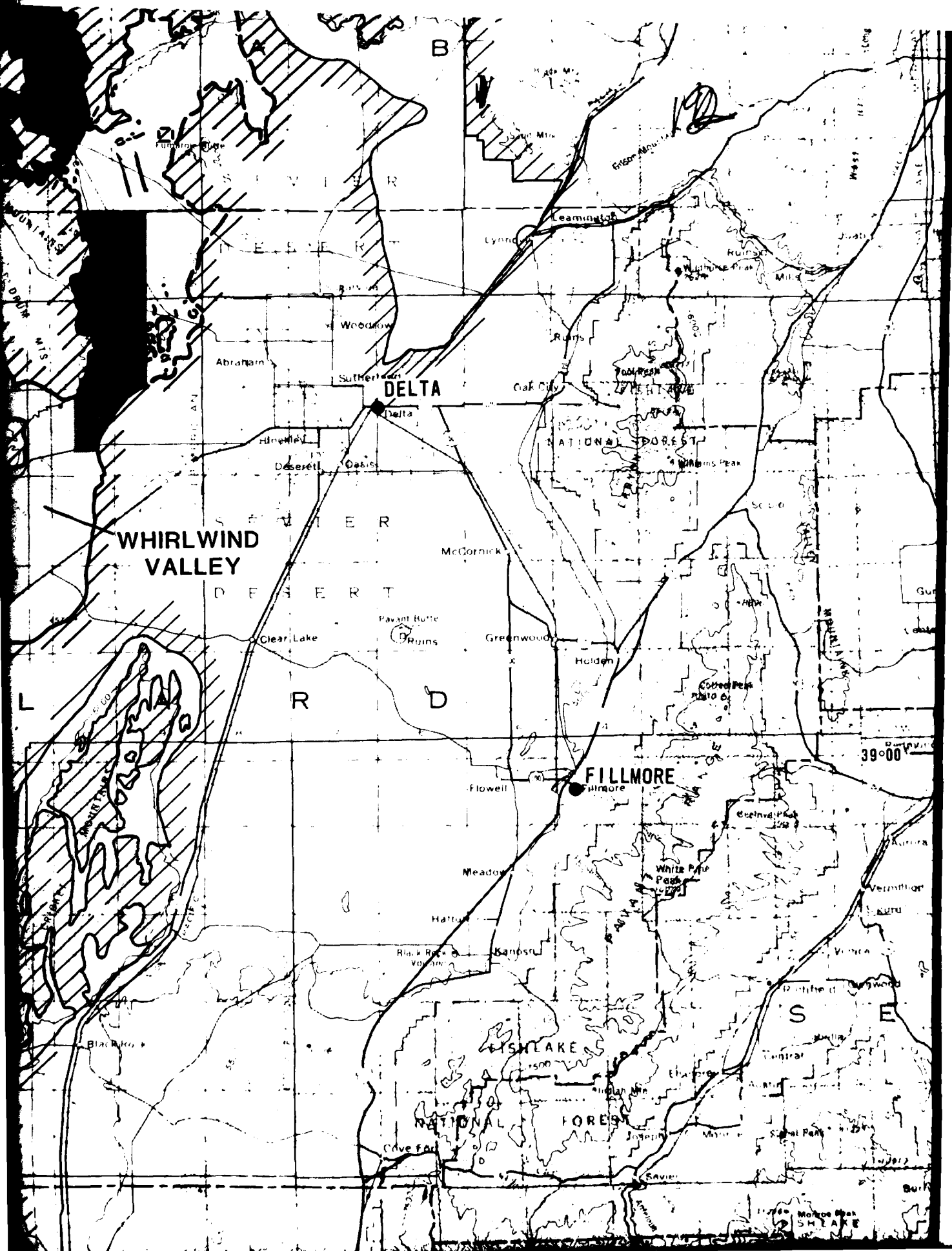












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BIG SMOKY VALLEY

9775
Mojave

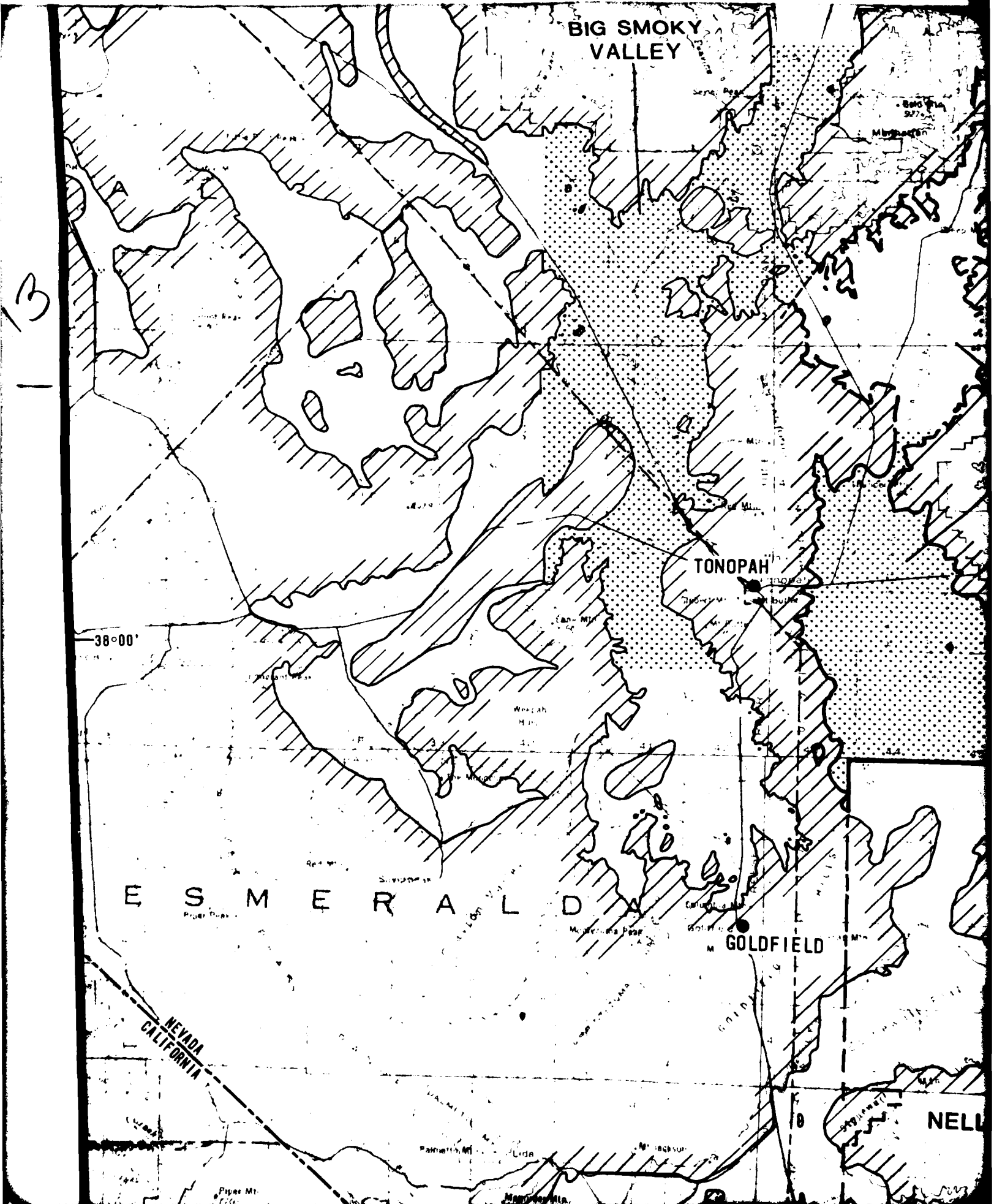
TONOPAH

E S M E R A L D

GOLDFIELD

NEVADA
CALIFORNIA

NELL



STONE CABIN
VALLEY

HOT CREEK
VALLEY

RALSTON
VALLEY

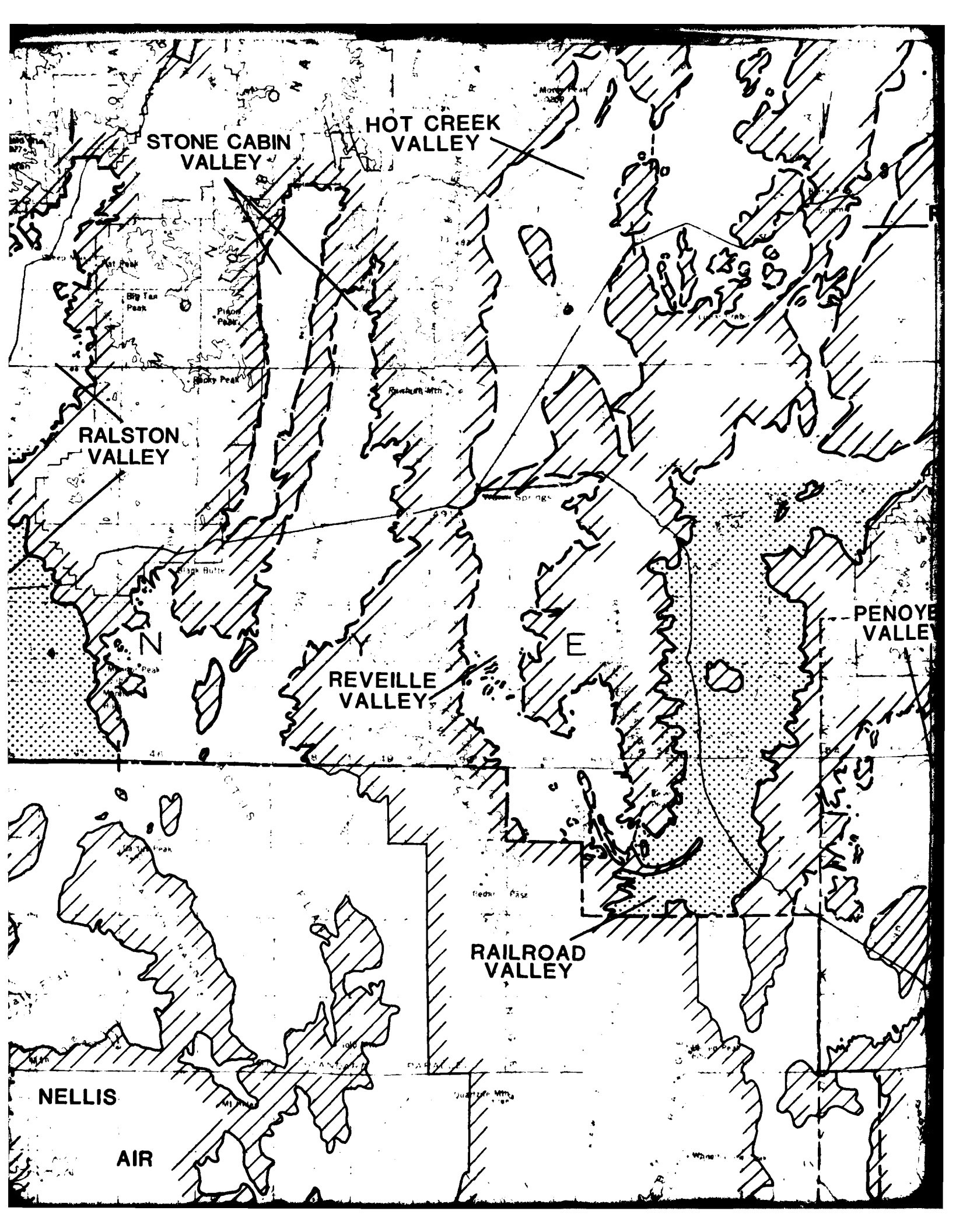
REVEILLE
VALLEY

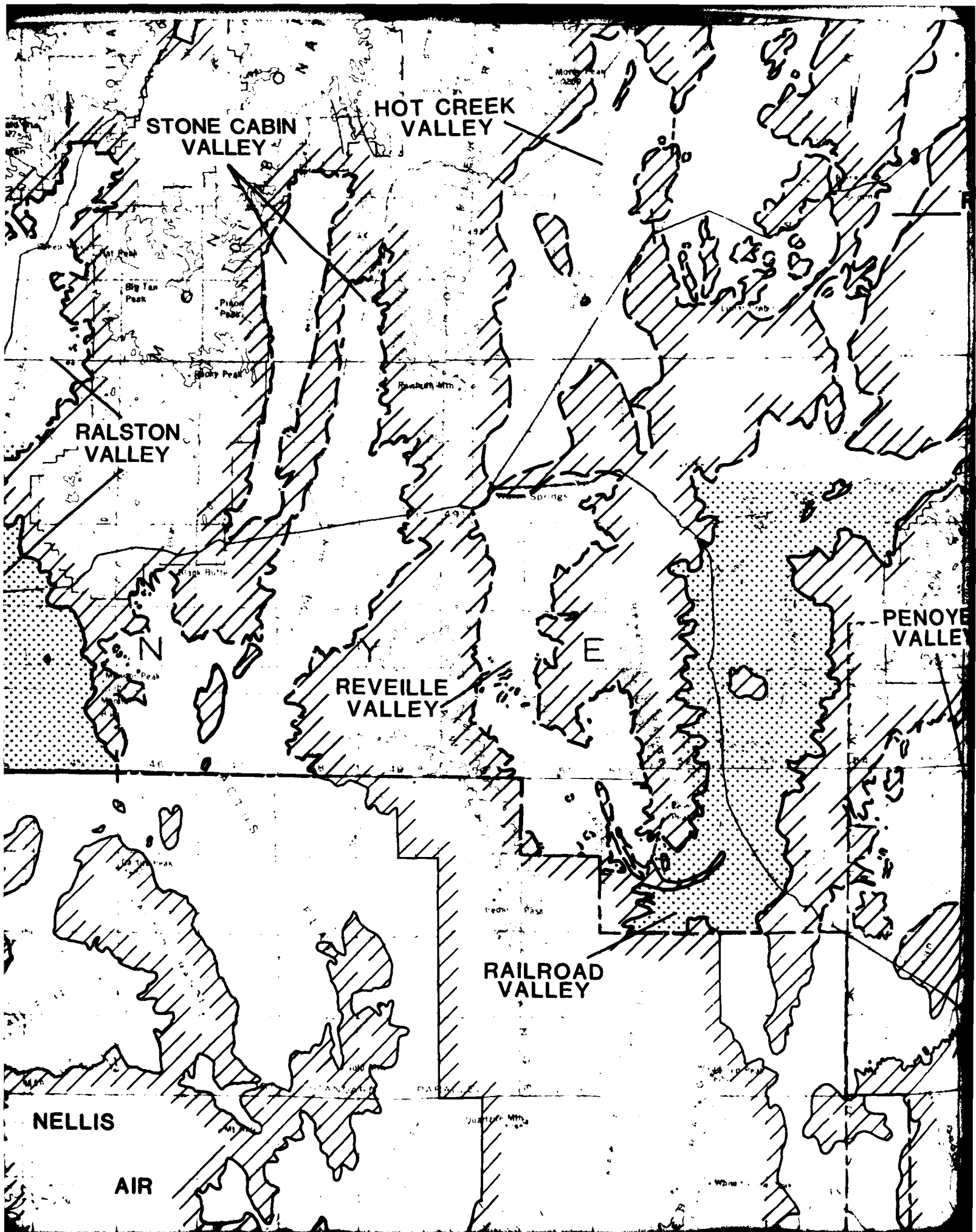
PENOYE
VALLEY

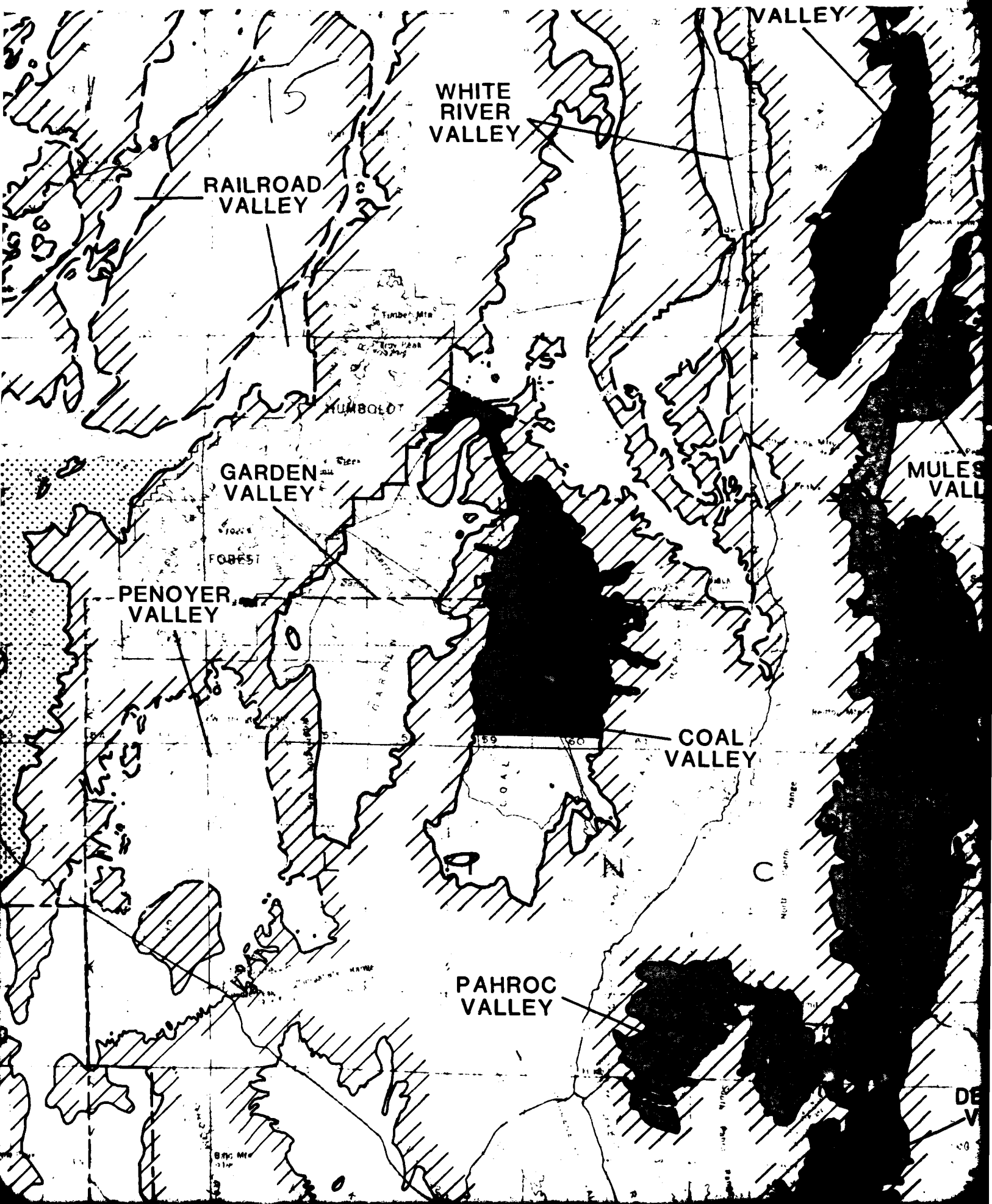
RAILROAD
VALLEY

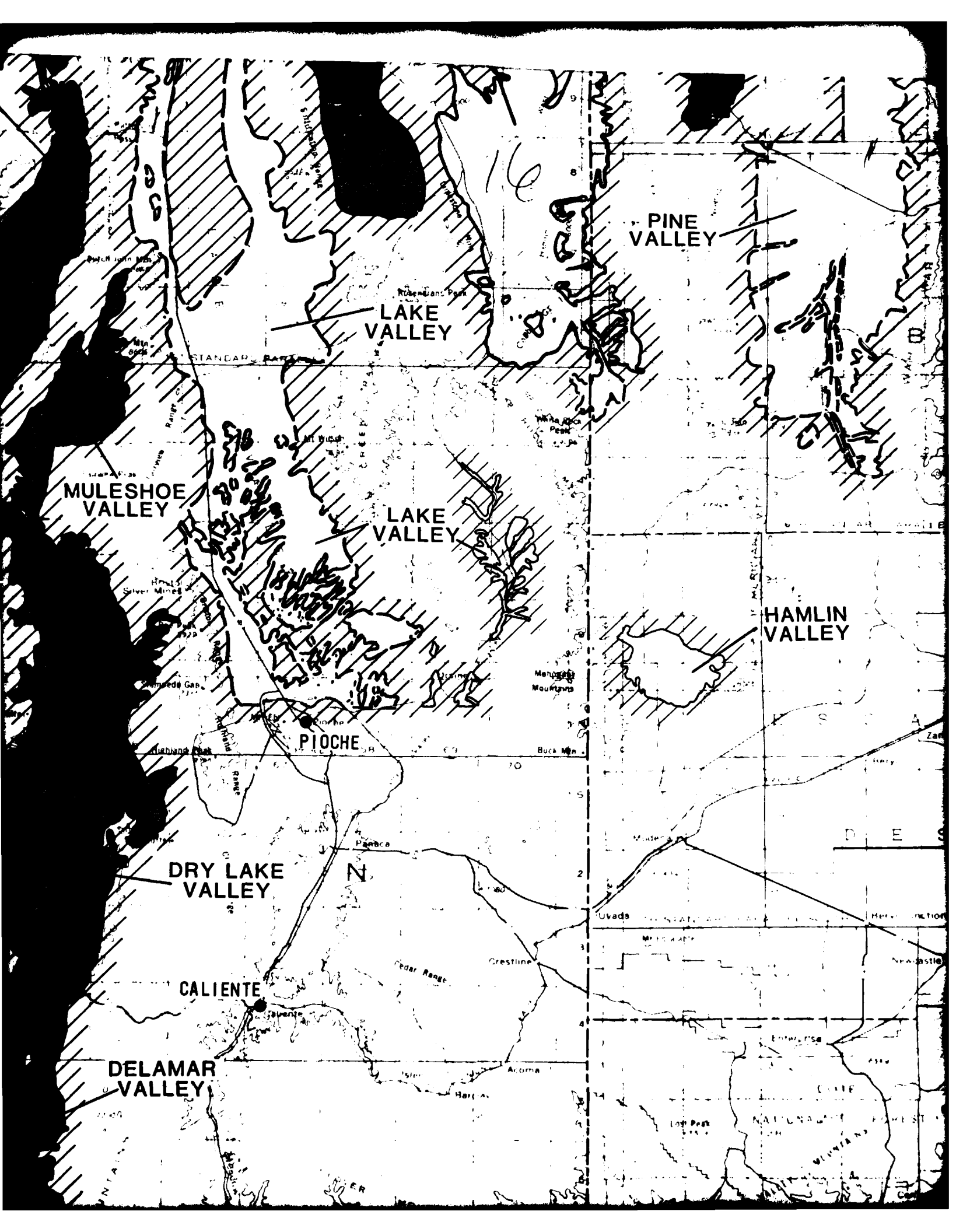
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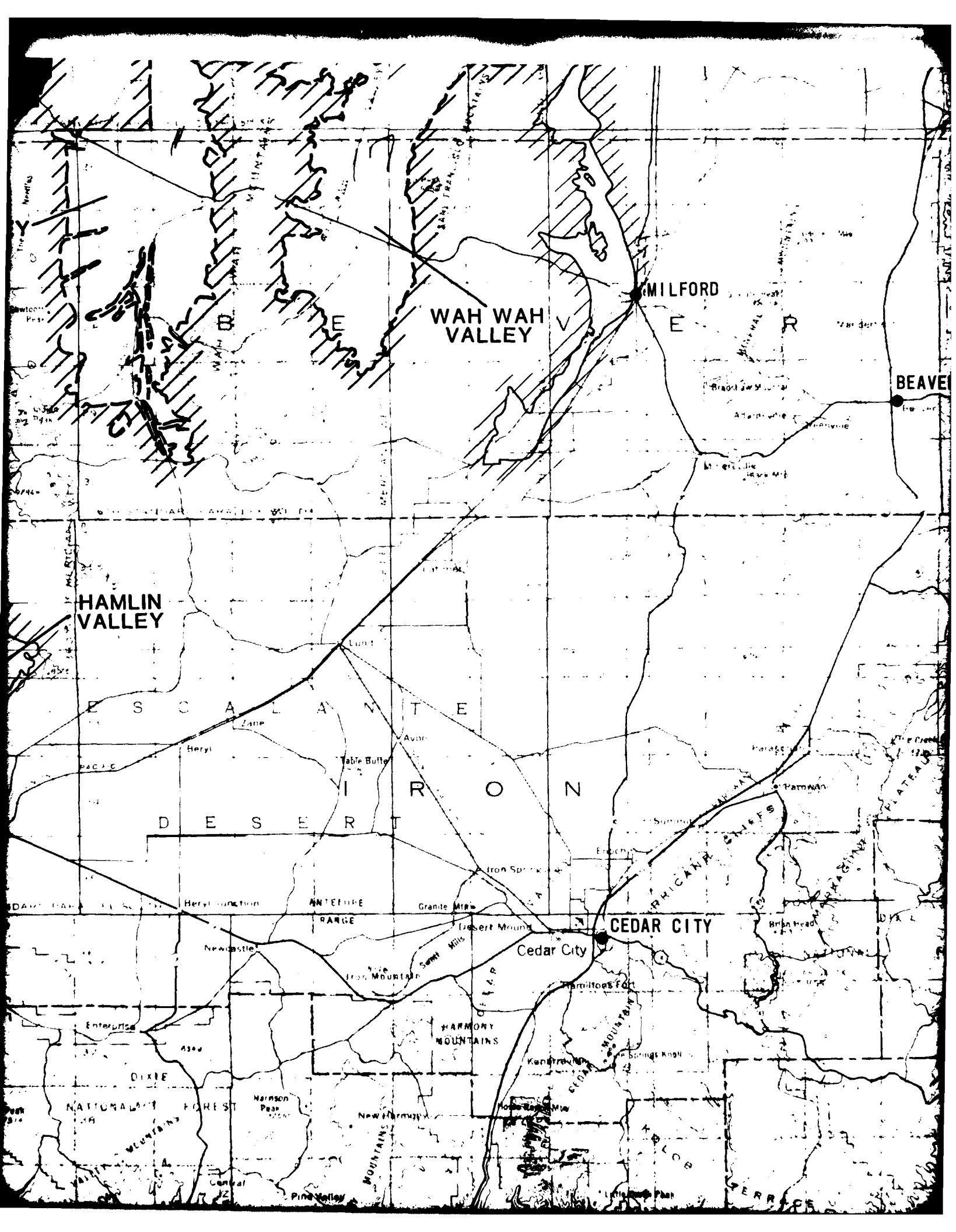
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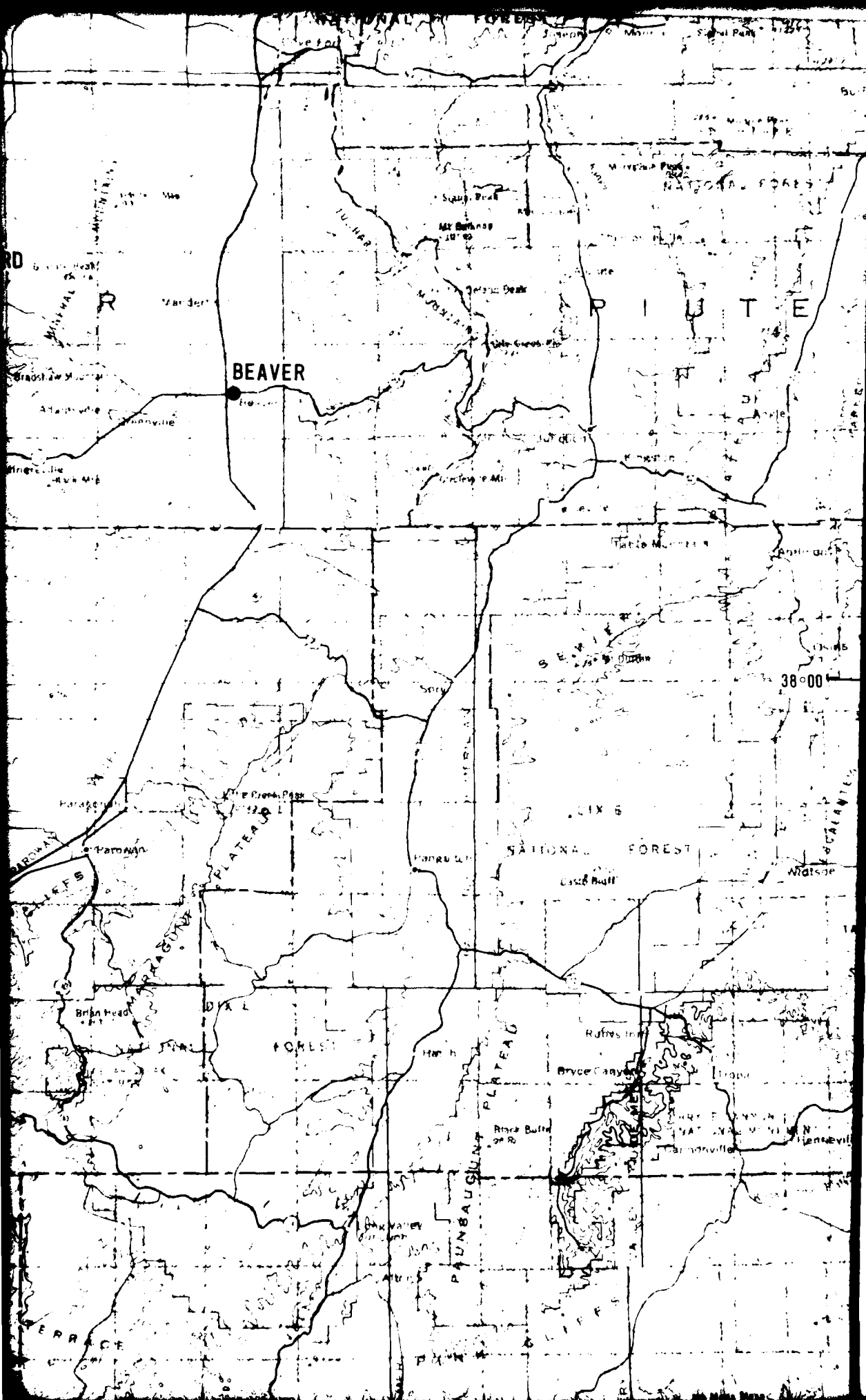






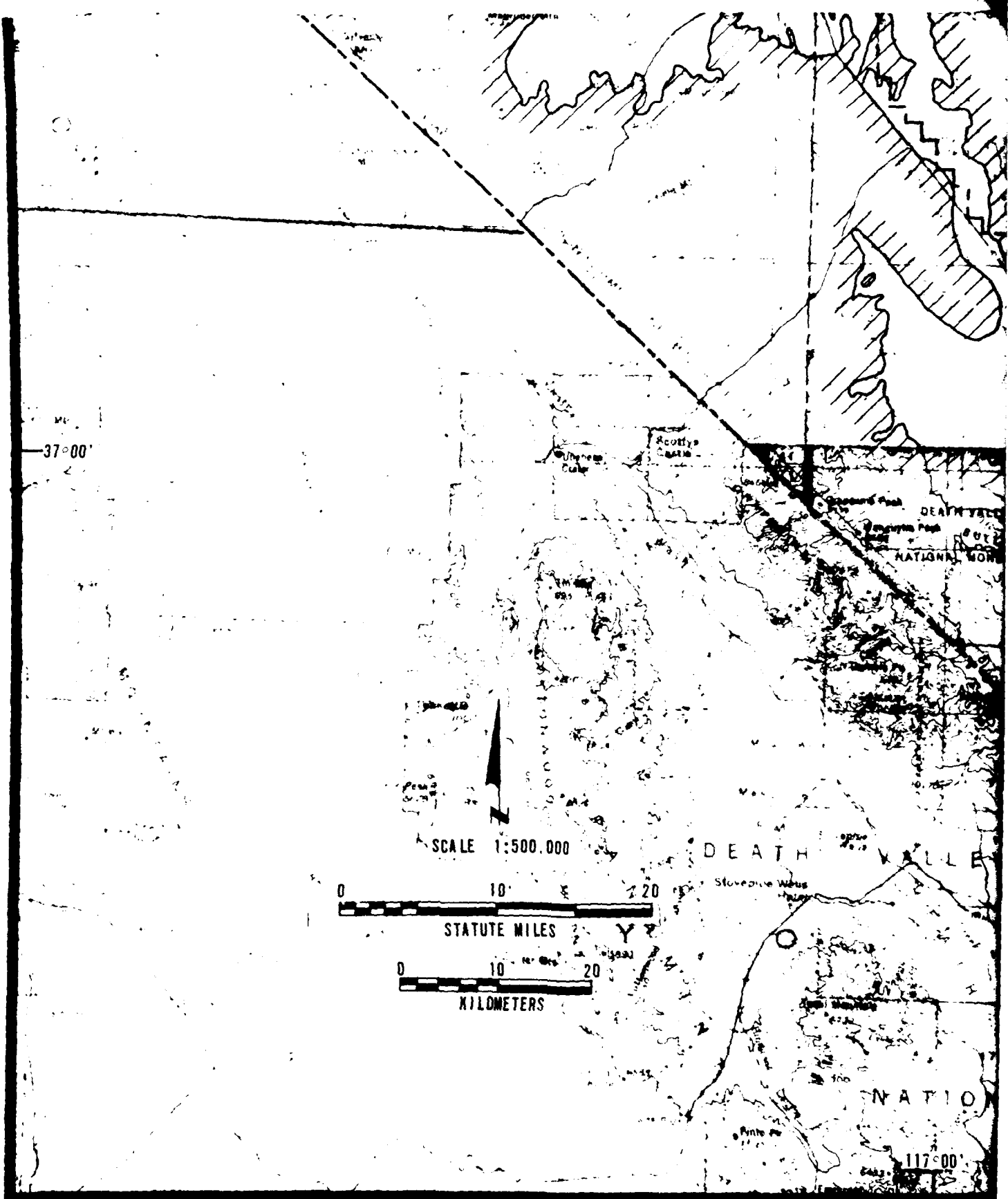




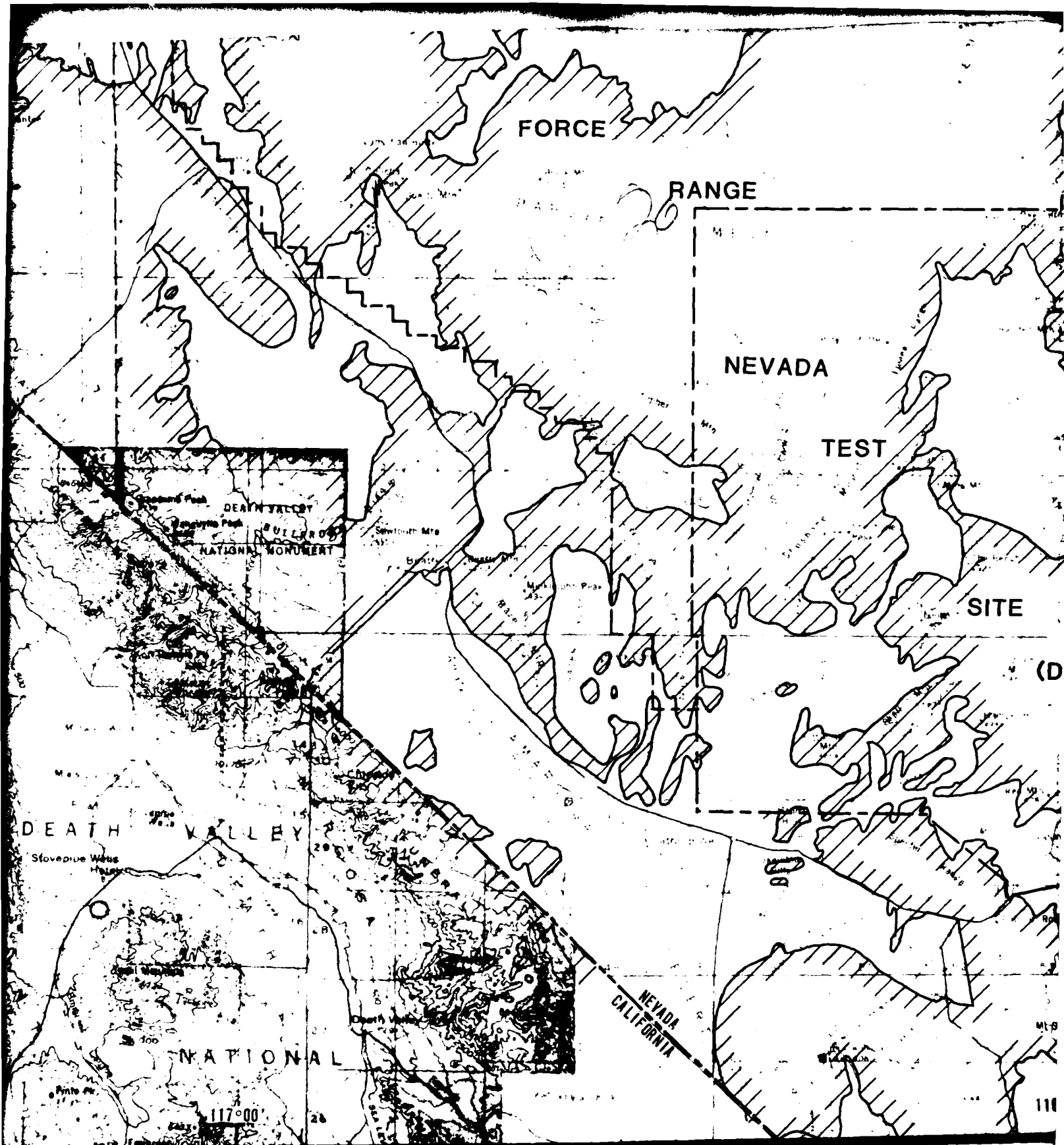


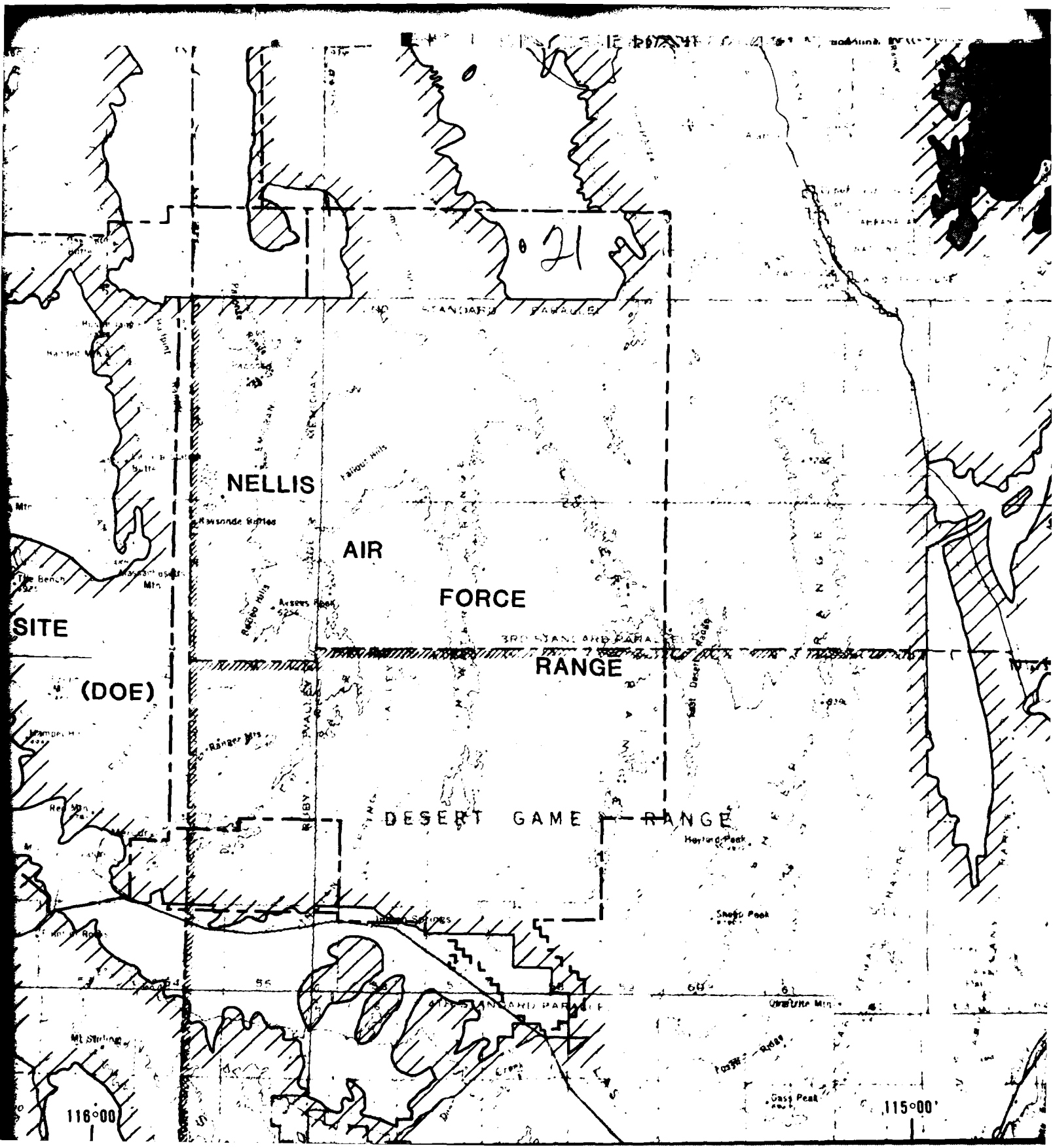
18

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2 JUL 80





SITE
(DOE)

NELLIS

AIR

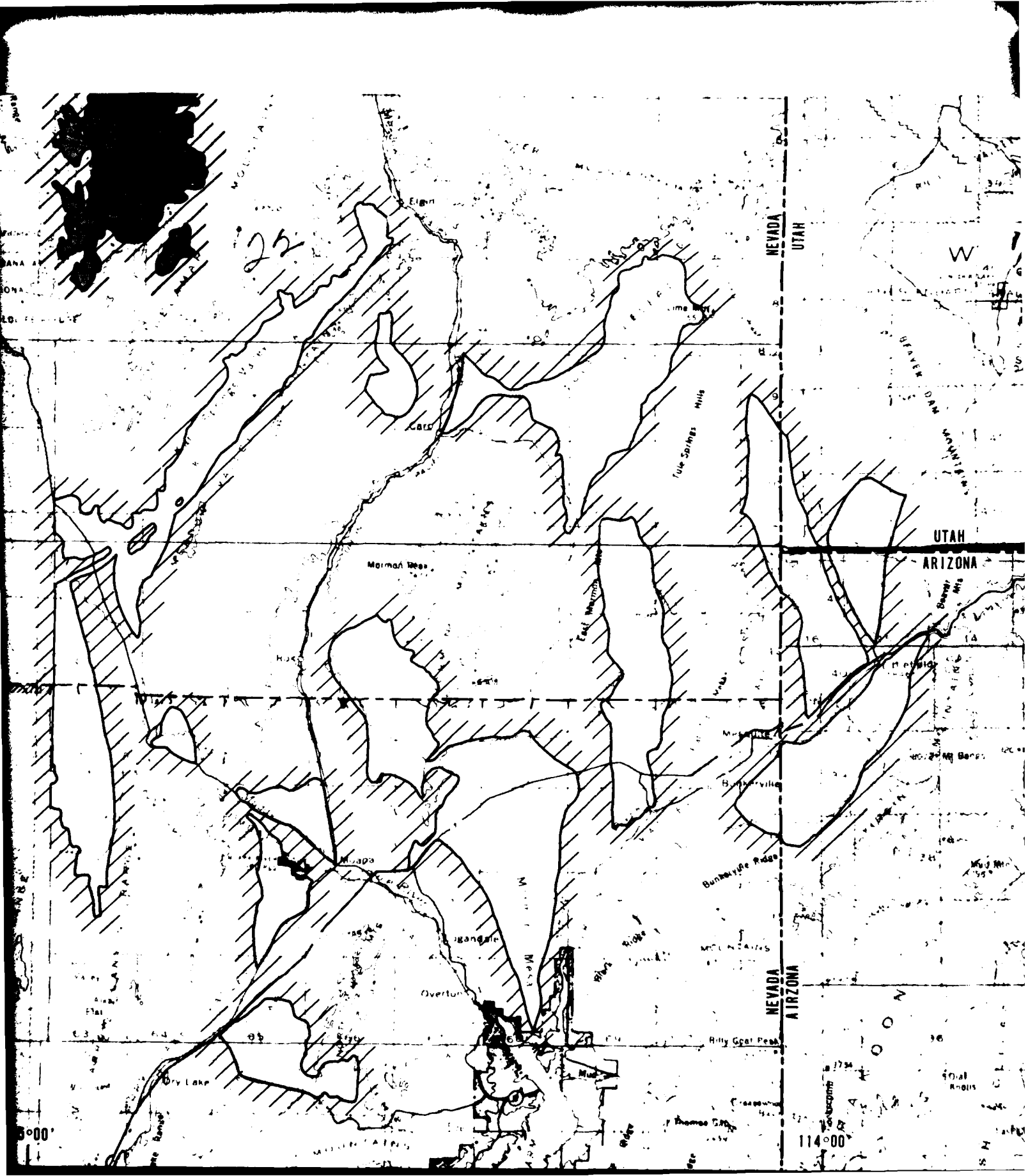
FORCE

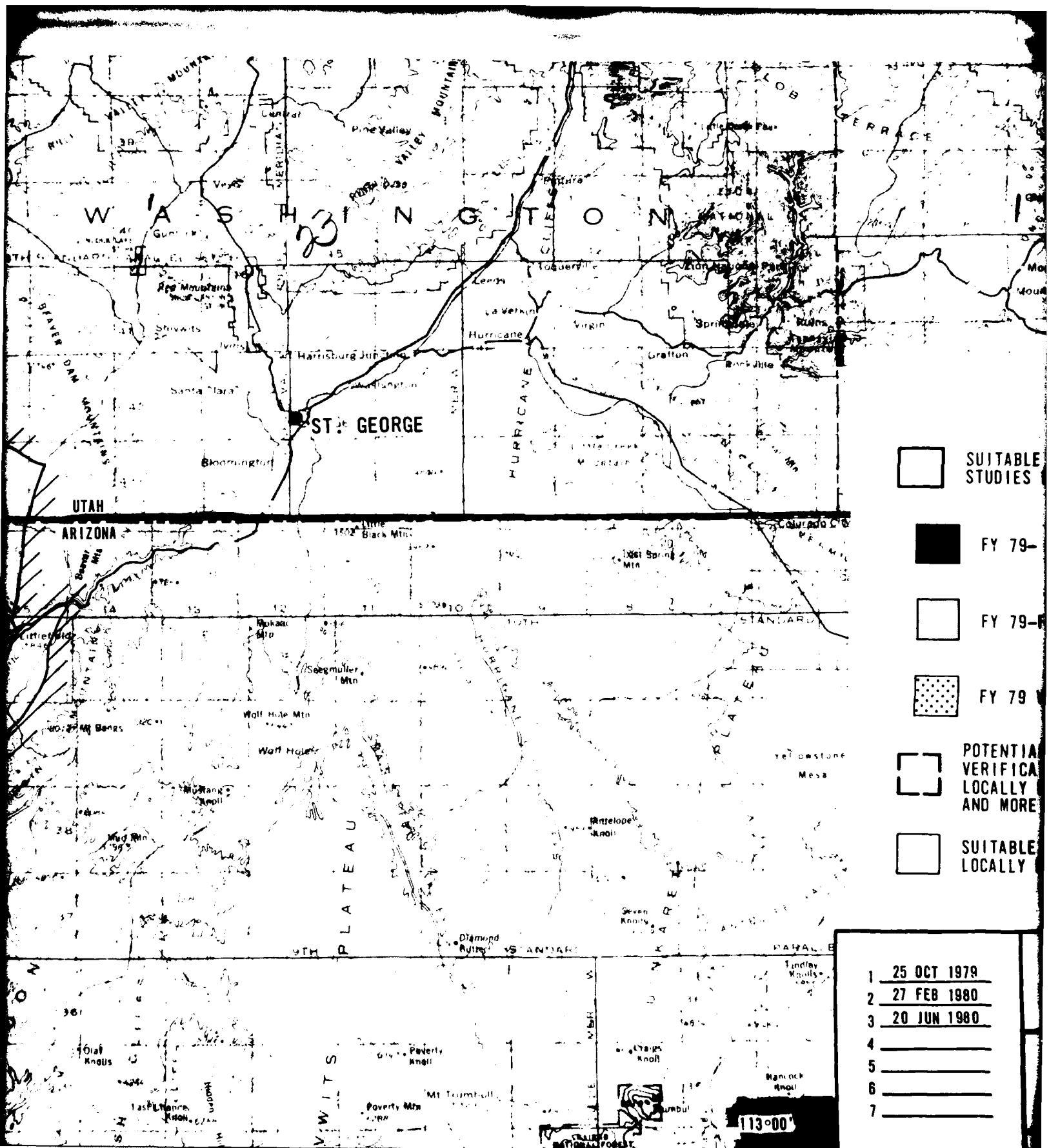
RANGE

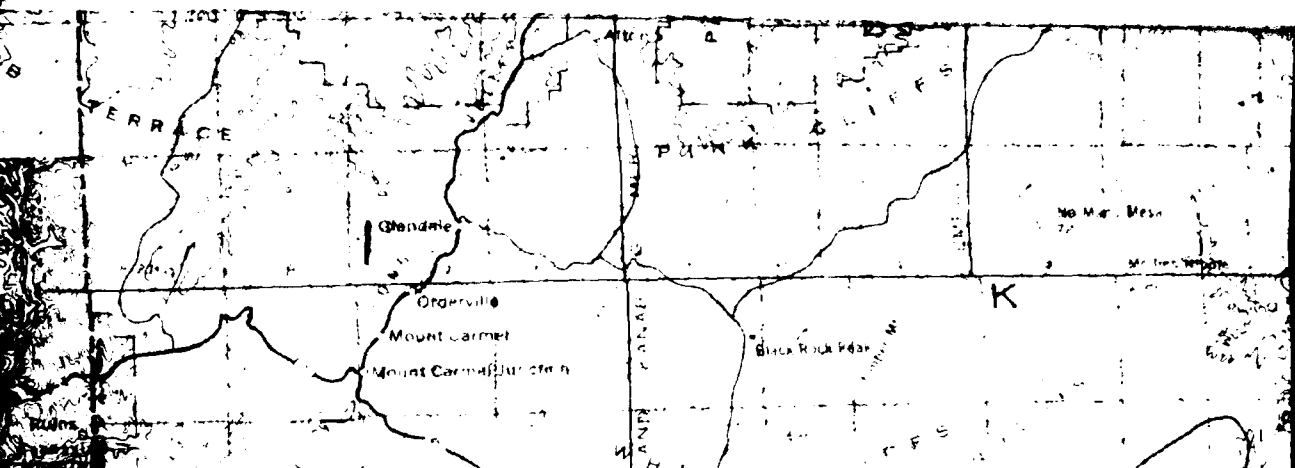
DESERT GAME RANGE

116°00'

115°00'







EXPLANATION

- ☐ SUITABLE AREA FOR HORIZONTAL SHELTER BASED ON VERIFICATION STUDIES FY 78 AND FY 79 AND DATA GAP STUDIES FY 79 AND FY 80.
- ☒ FY 79- FY 80 VERIFICATION AREAS.
- ☐ FY 79-FY 80 DATA GAP AREAS.
- ☒ FY 79 VERIFICATION AREAS WITHOUT SUBSEQUENT DATA GAP.
- ☐ POTENTIALLY SUITABLE AREA TO BE INVESTIGATED BY FY 80 VERIFICATION STUDIES. BASED ON REGIONAL SCREENING STUDIES, LOCALLY MODIFIED BY PRELIMINARY RESULTS OF FY 80 VERIFICATION AND MORE DETAILED LITERATURE-BASED REVIEW OF GROUND WATER DATA.
- ☐ SUITABLE AREA FOR HORIZONTAL SHELTER BASED ON SCREENING STUDIES LOCALLY MODIFIED BY PRIOR VERIFICATION STUDIES.

GEOTECHNICALLY SUITABLE AREAS NEVADA-UTAH

1 25 OCT 1979
2 27 FEB 1980
3 20 JUN 1980
4 _____
5 _____
6 _____
7 _____

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE - BMD

DRAWING

1-1

FUGRO NATIONAL, INC.

EXPLANATION



Area suitable for horizontal and vertical shelter basing modes. Depth to rock and or water greater than 150 feet (46m).



Area suitable for horizontal shelter but not suitable for vertical shelter. Depth to rock and or water greater than 50 feet (15m) and less than 150 feet (46m).



Area unsuitable for both horizontal and vertical shelter basing modes as determined from application of depth to rock and/or water, topographic terrain and cultural exclusions.



Areas of exposed rock.



Contact between rock and basin fill.



Limit of study for this report, including cultural boundaries (National Forest, DoD land, etc.).

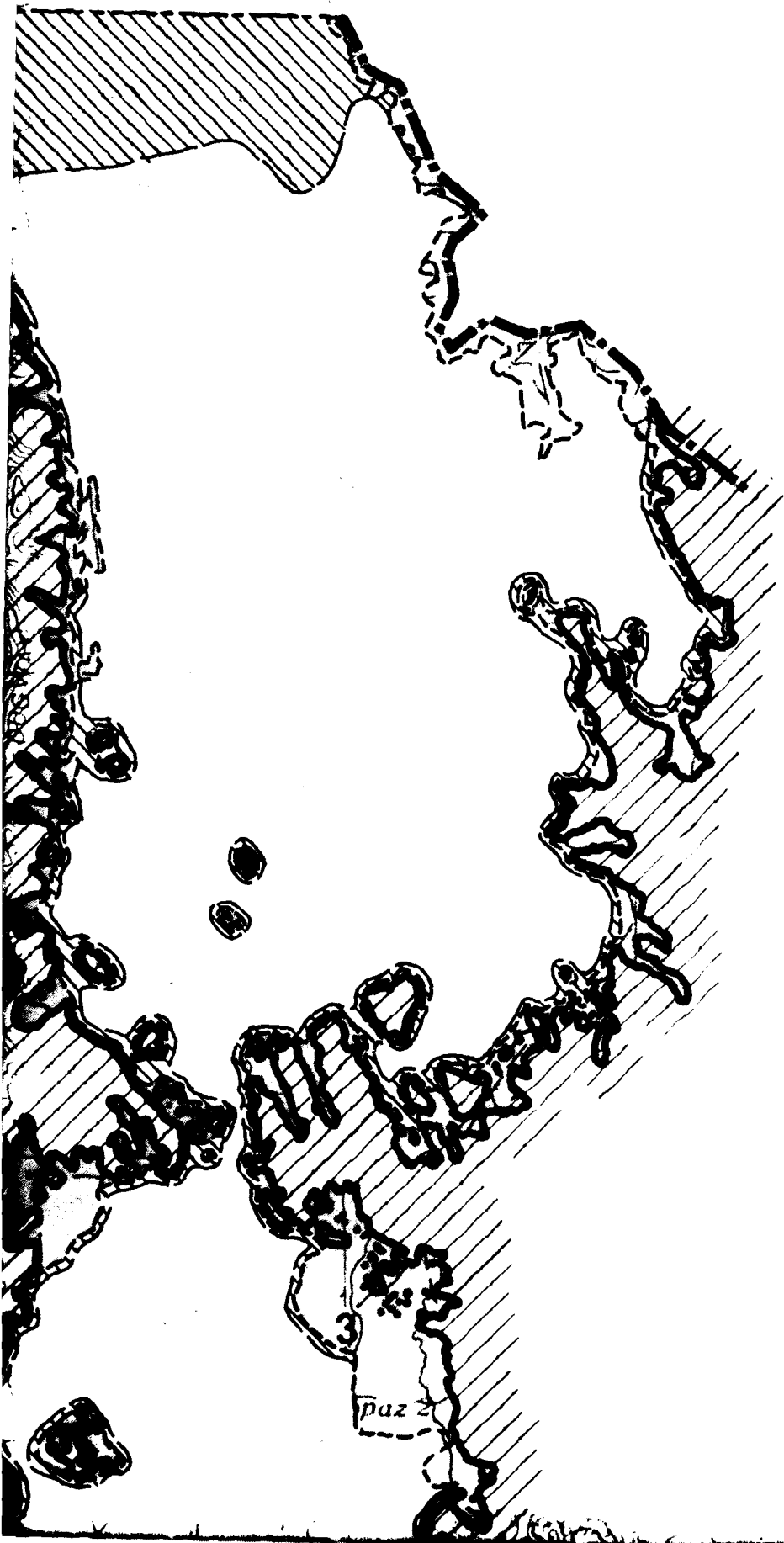


Geographic limit of verification valley.



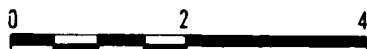
SCALE 1:125,000

paz

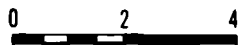


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SCALE 1:125,000



STATUTE MILES



KILOMETERS



SUITABLE AREA

DUGWAY VALLEY, UTAH

MX SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMD

DRAWING

3-1

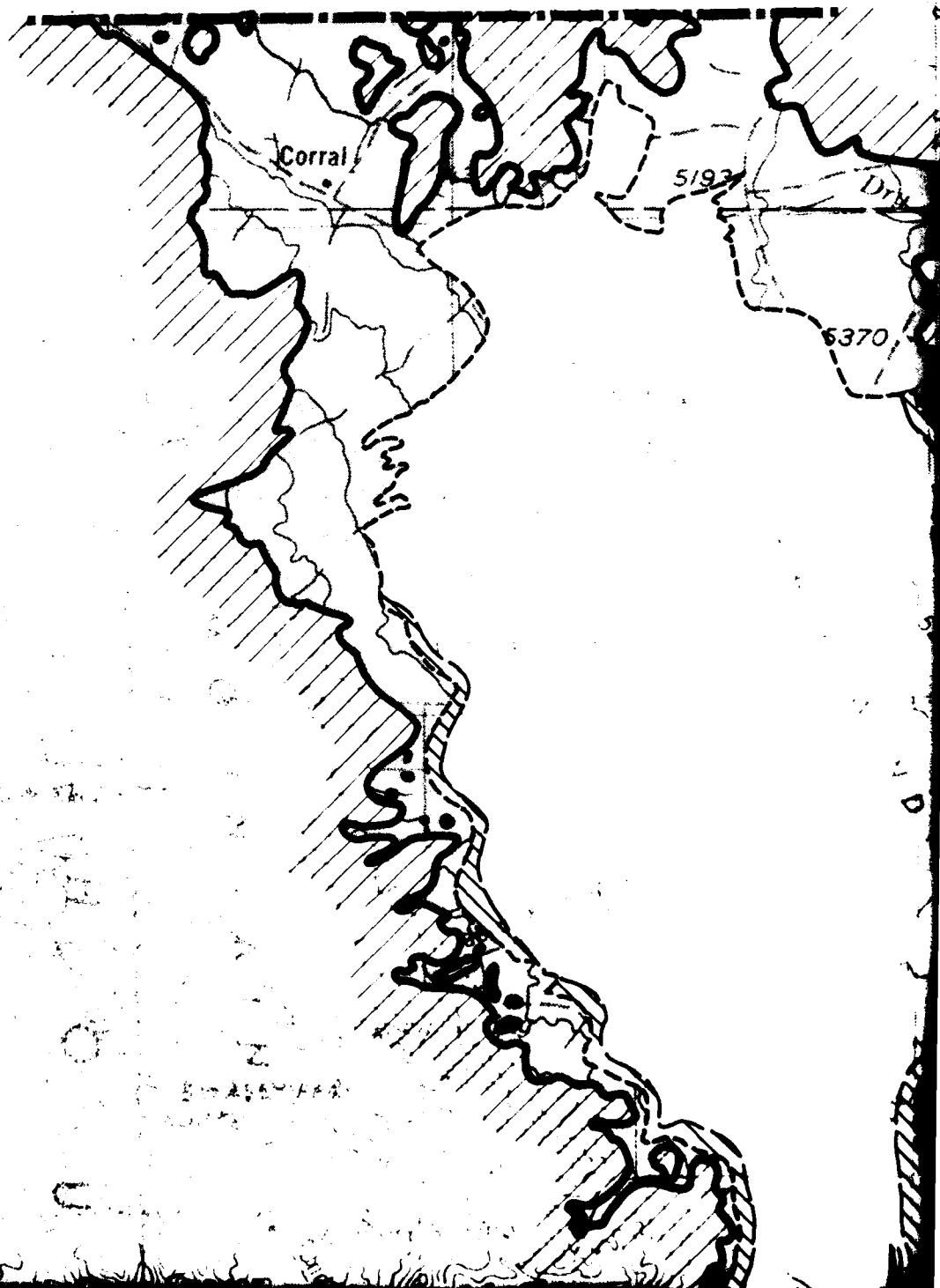
GUARD NATIONAL, INC.

paz 2

4-106

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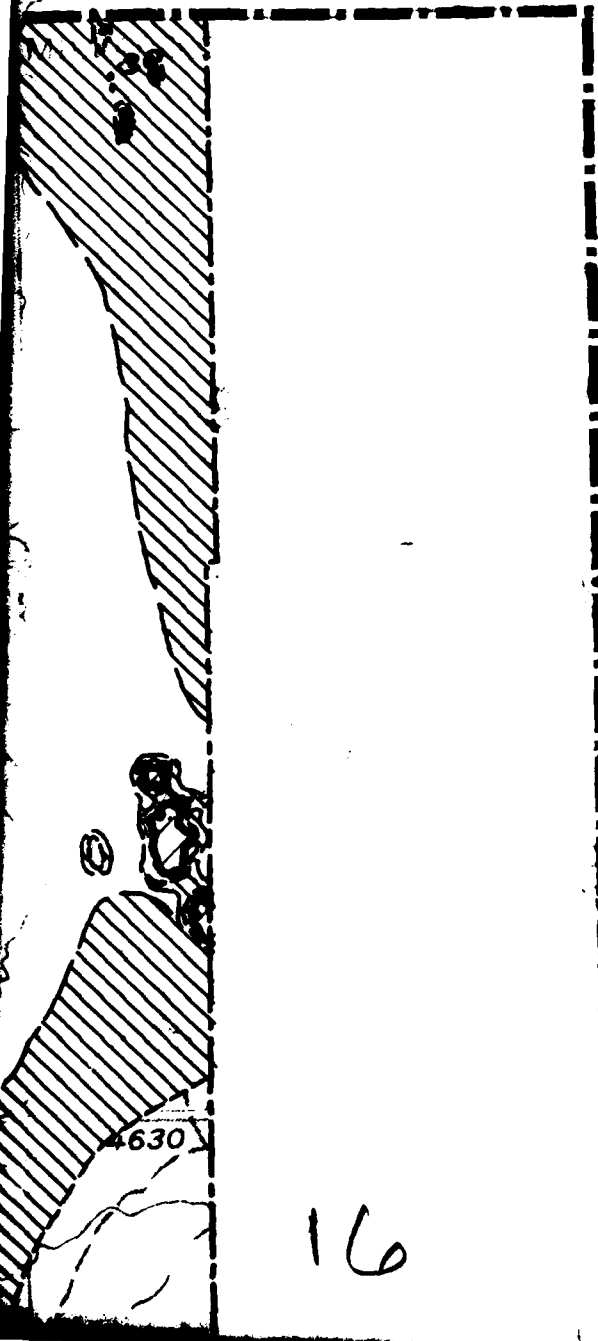
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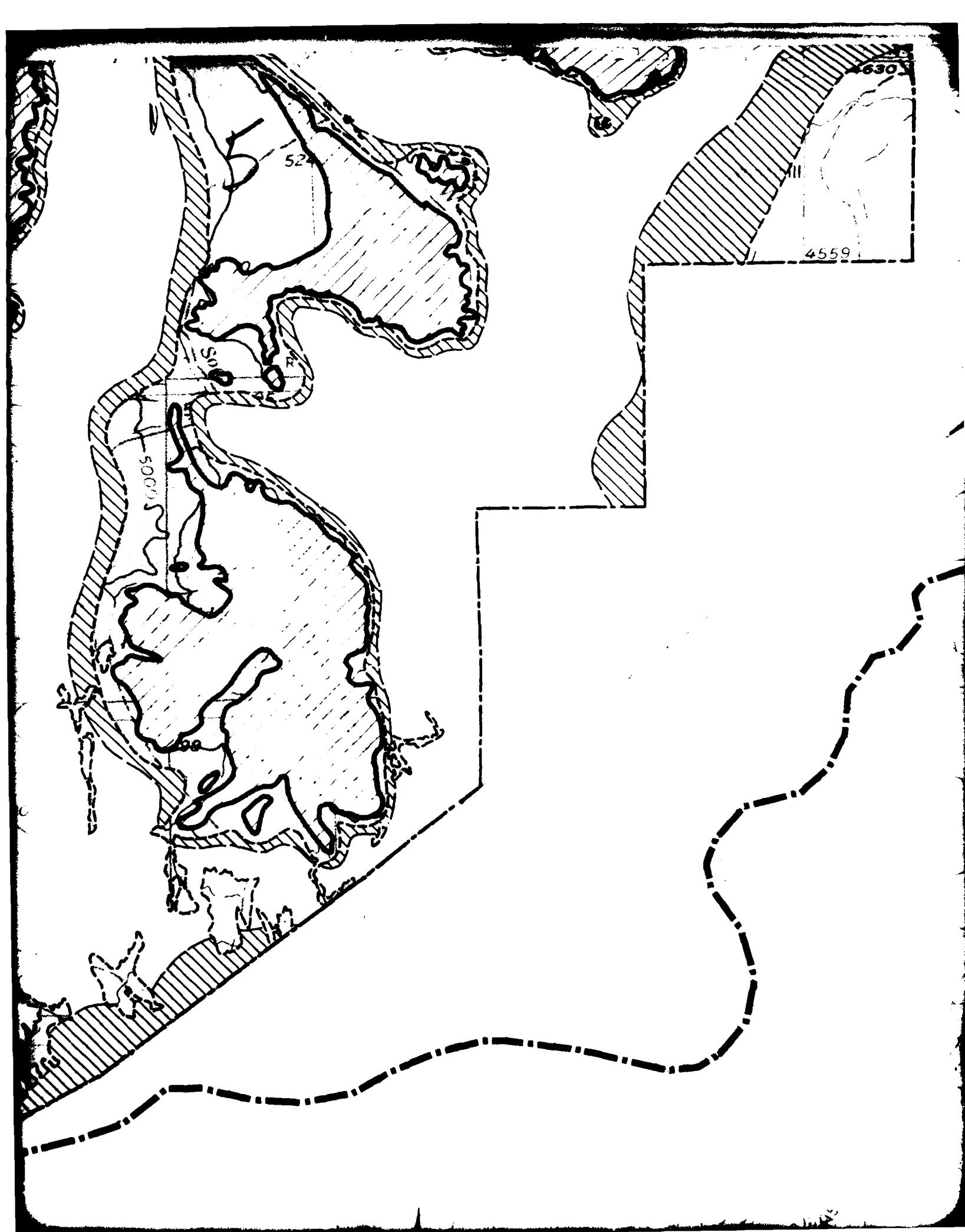
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SUITABLE AREA
WHIRLWIND VALLEY, UTAH

WE SITTING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMD

3-2

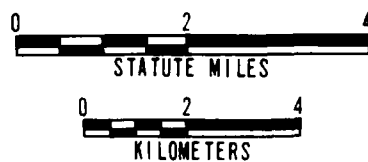
DRAWING

FIGARO NATIONAL, INC.








146



SCALE 1:125,000



EXPLANATION

-  Area suitable for horizontal and vertical shelter basing modes. Depth to rock and/or water greater than 150 feet (46m).
-  Area suitable for horizontal shelter but not suitable for vertical shelter. Depth to rock and/or water greater than 50 feet (15m) and less than 150 feet (46m).
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-  Areas of exposed rock.
-  Contact between rock and basin fill.
-  Limit of study for this report, including cultural boundaries (National Forest, DoD land, etc.).
-  Geographic limit of verification valley.

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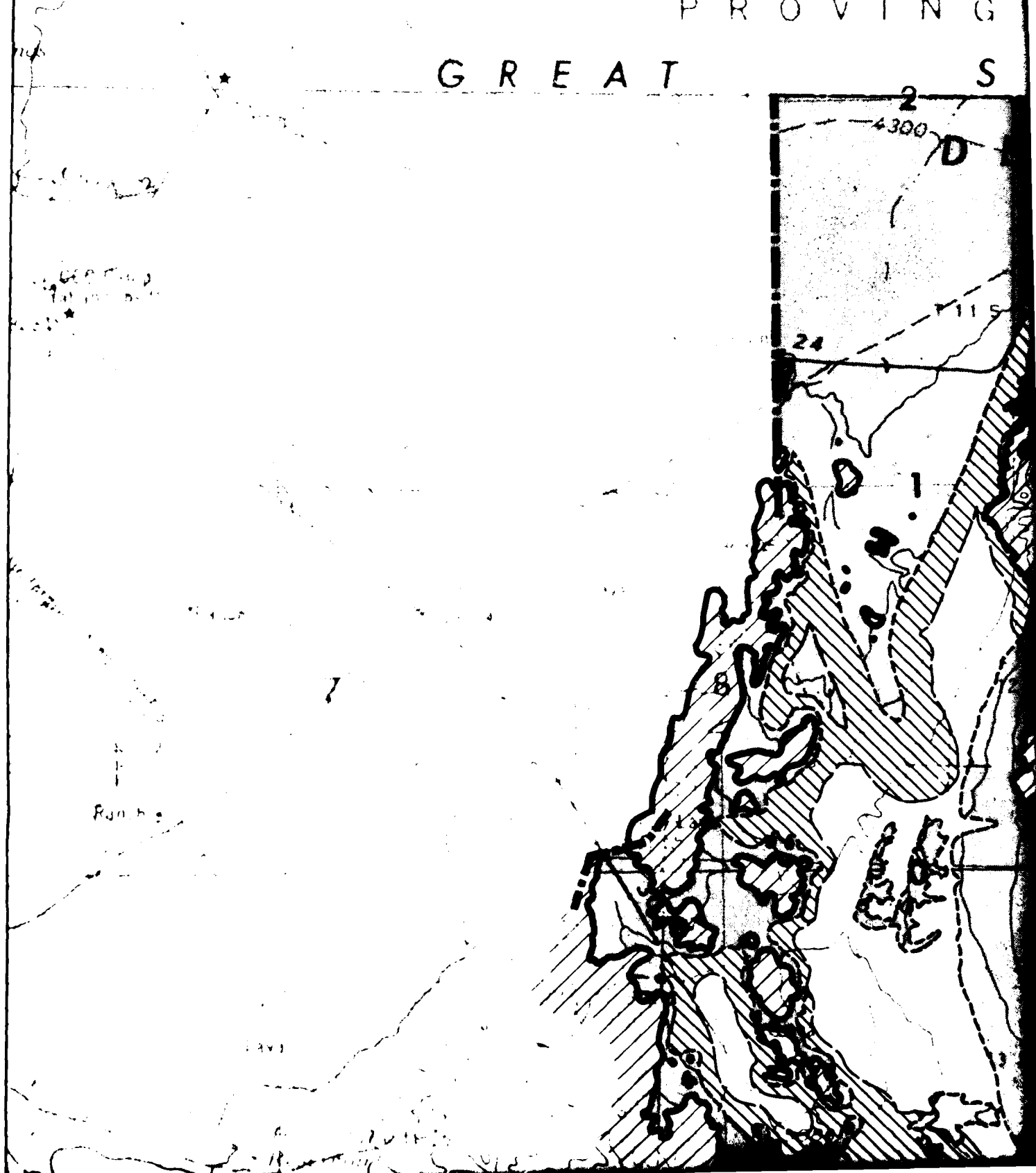
eral boundaries

2 JUL 80

DUG

PROVING

GREAT S



12

DUGWAY

ING GROUND

SALT LAKE

PM-18-38-1

DESERT

FISH SPRINGS RANGE

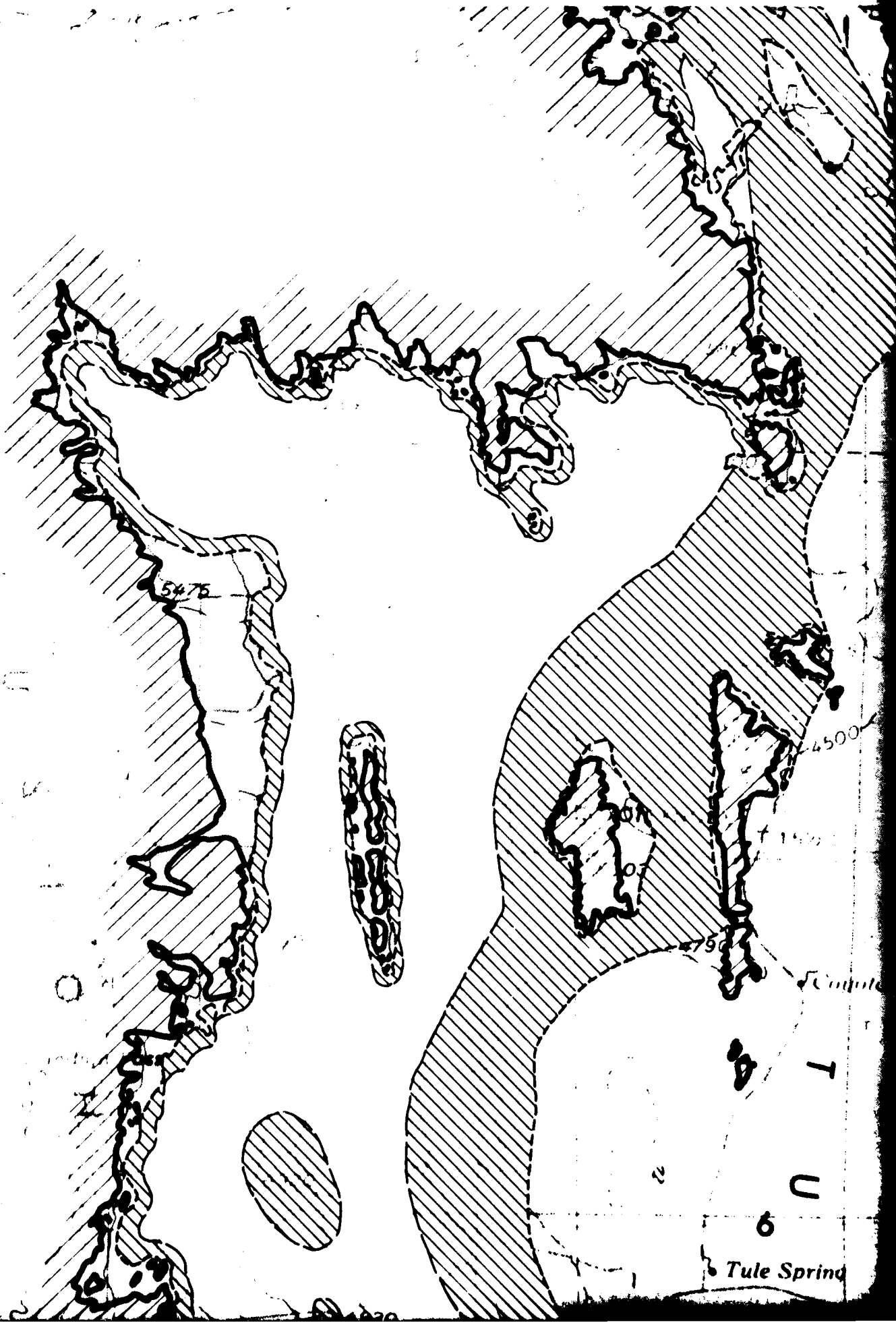
FISH

SPRING

FLAT



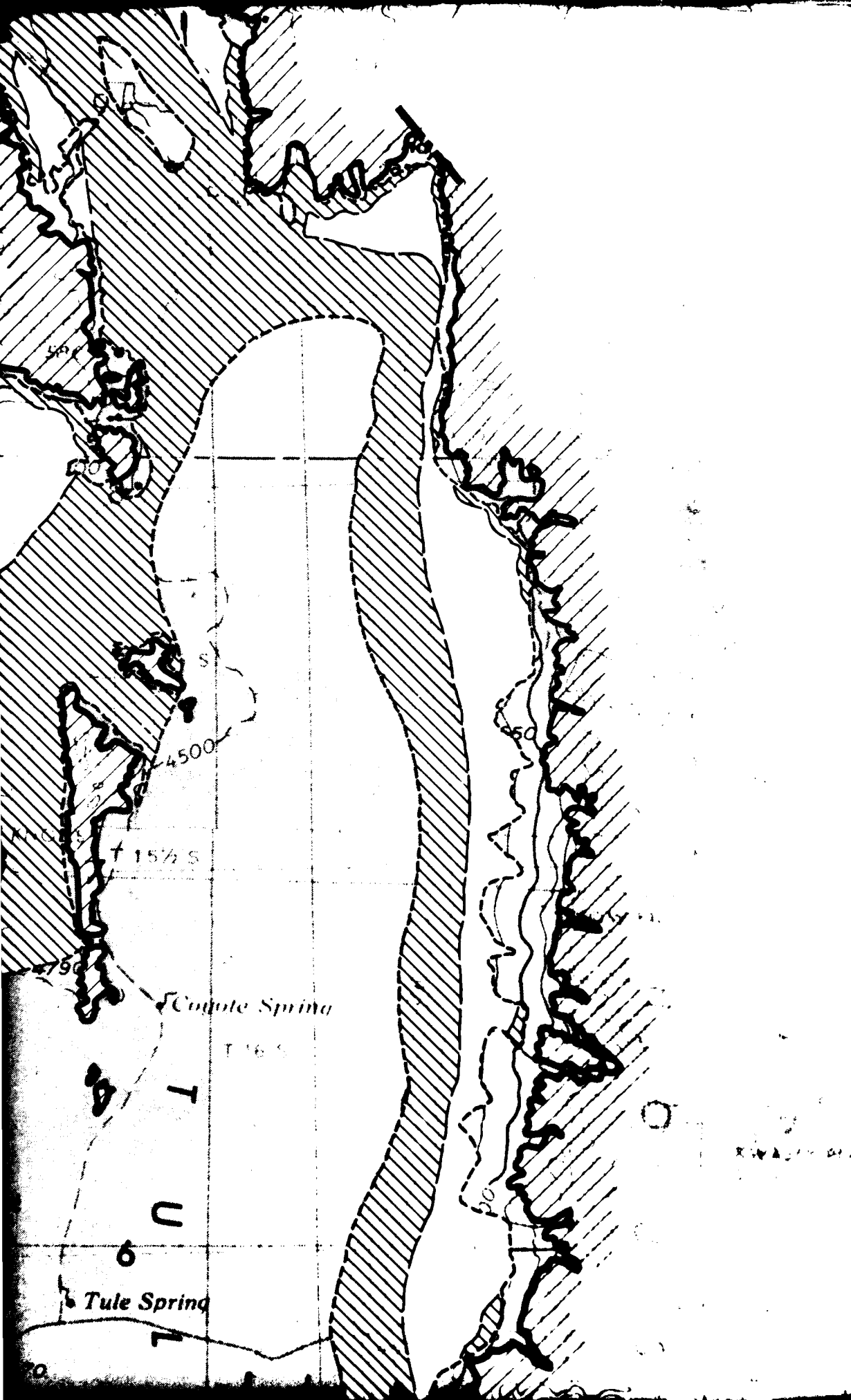
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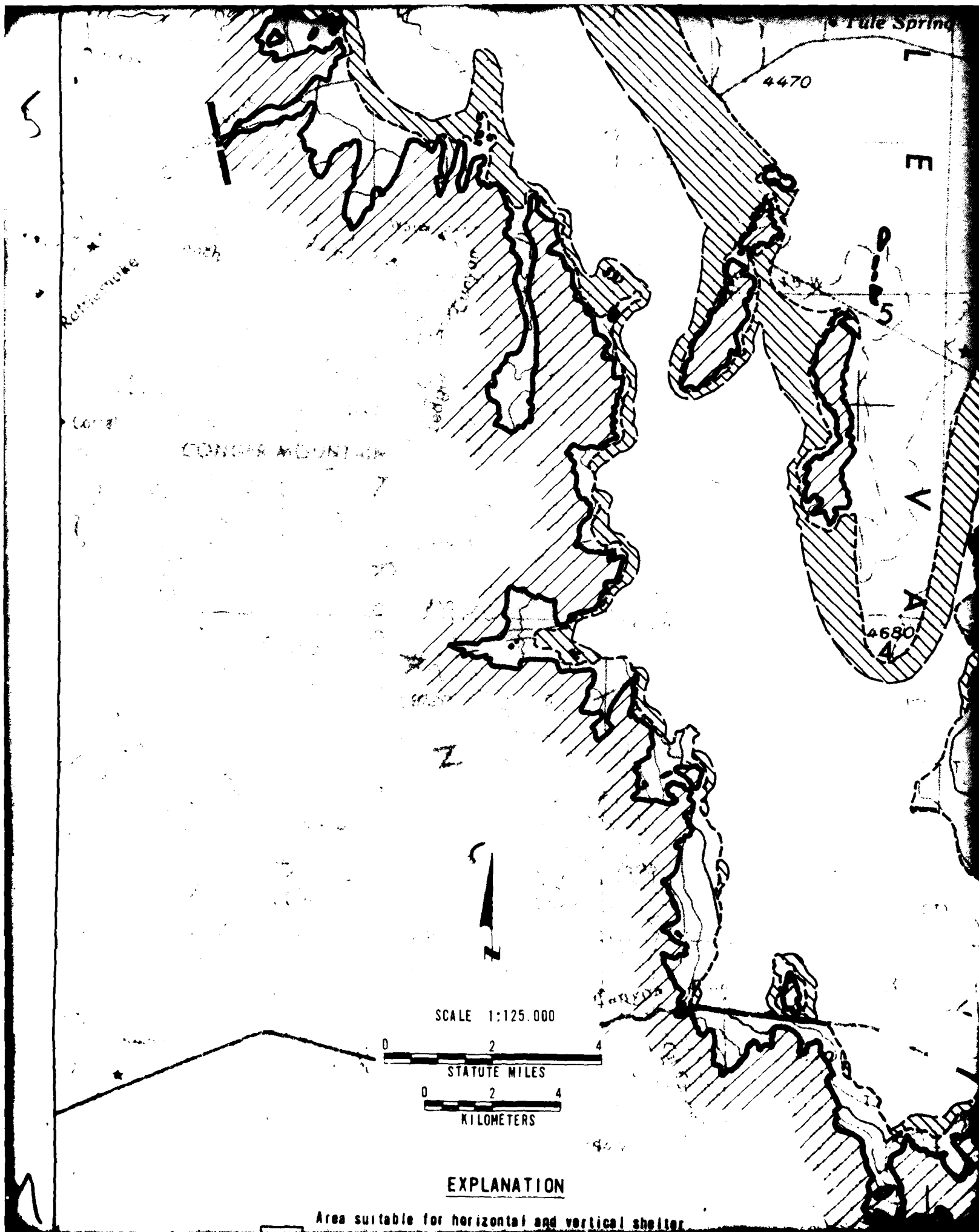


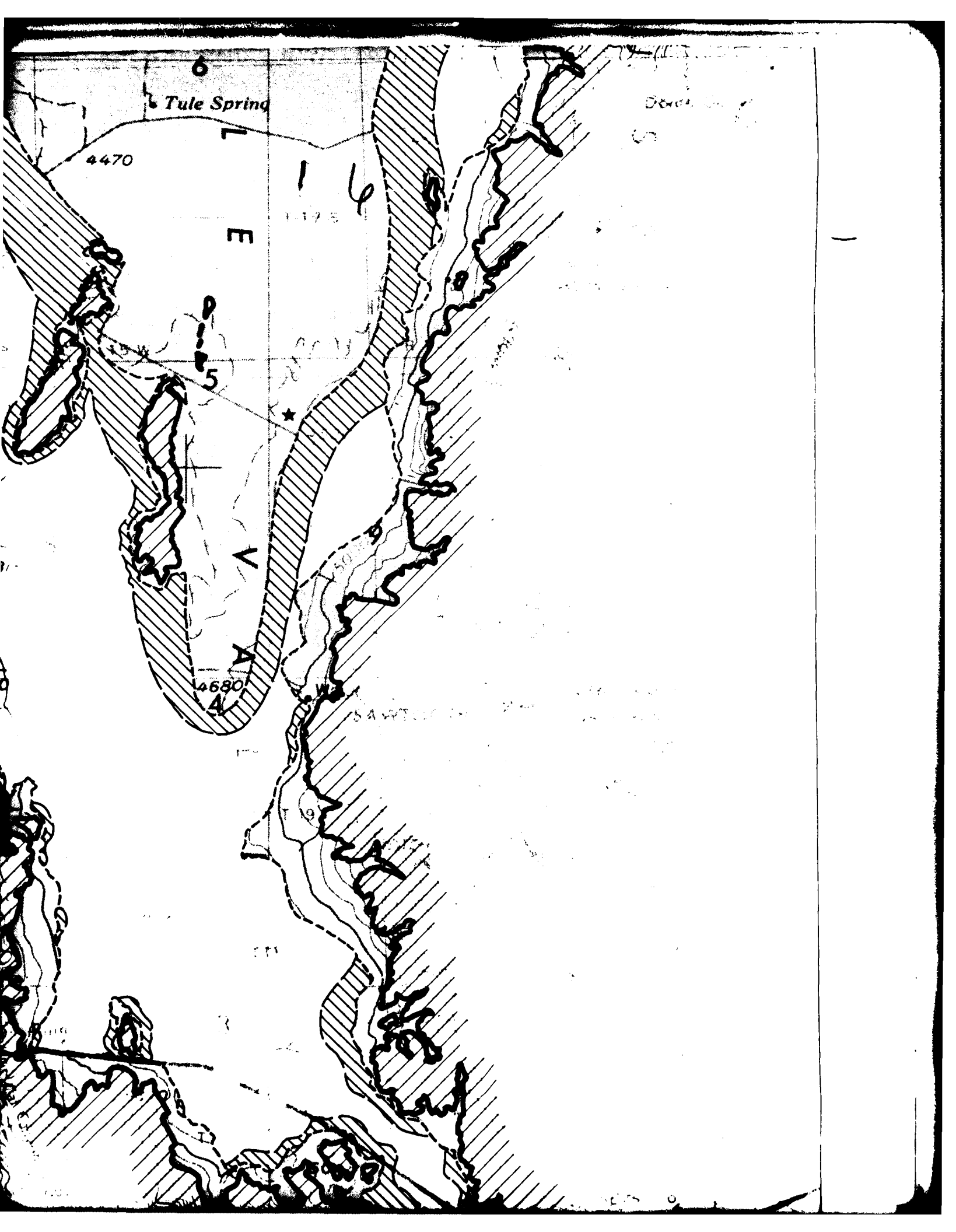
70390

Tule Spring

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STATUTE MILES

0 2 4

KILOMETERS

EXPLANATION

-  Area suitable for horizontal and vertical shelter basing modes. Depth to rock and or water greater than 150 feet (46m).
-  Area suitable for horizontal shelter, but not suitable for vertical shelter. Depth to rock and or water greater than 50 feet (15m) and less than 150 feet (46m).
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-  Contact between rock and basin fill.
-  Limit of study for this report, including cultural boundaries (National Forest, DoD Land, etc.)
-  Geographic limit of verification valley.

FERGUSON

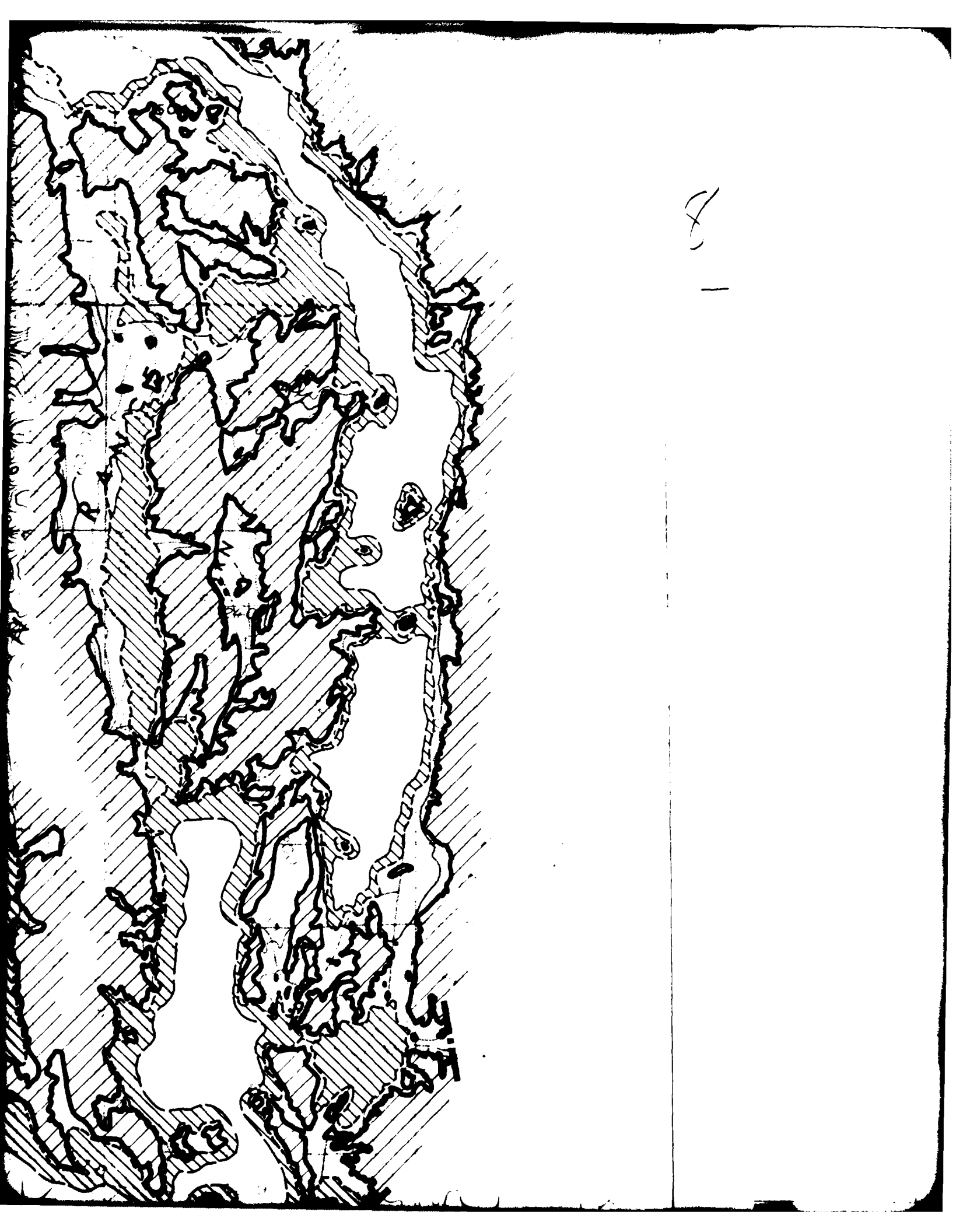
SEPT

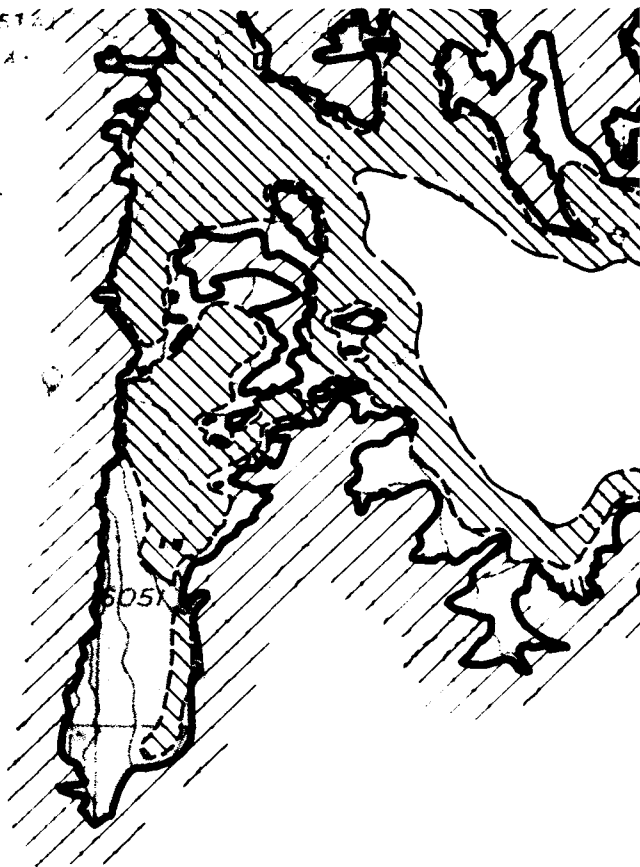
MISSION

W. K. R. R.

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FIN

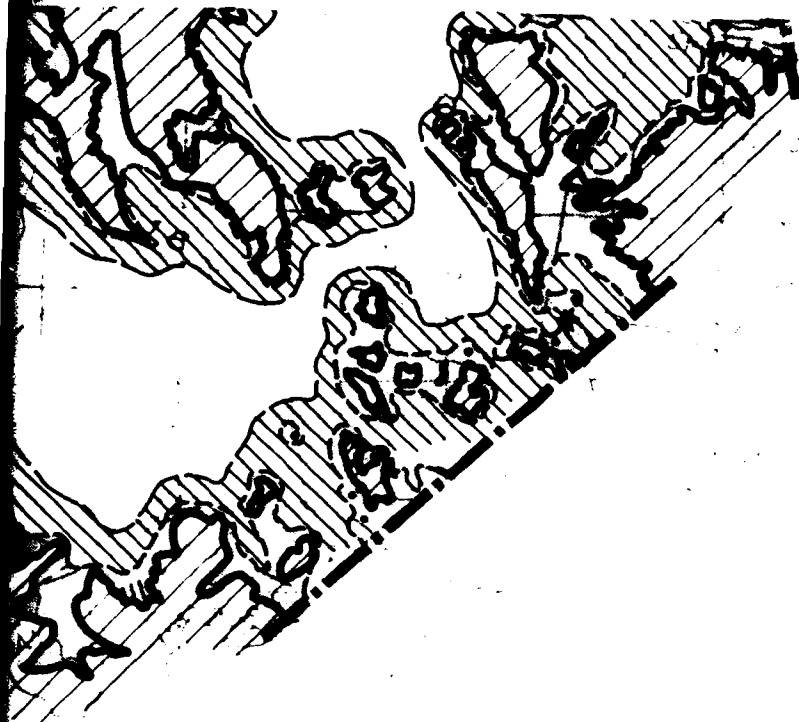




SUITABLE AREA	
TULE VALLEY, UTAH	
VEGETATION INVESTIGATION	DRAWING
WATERWAY OF MOUNTAIN RIVER CANAL	3-3

FUGRO NATIONAL, INC.

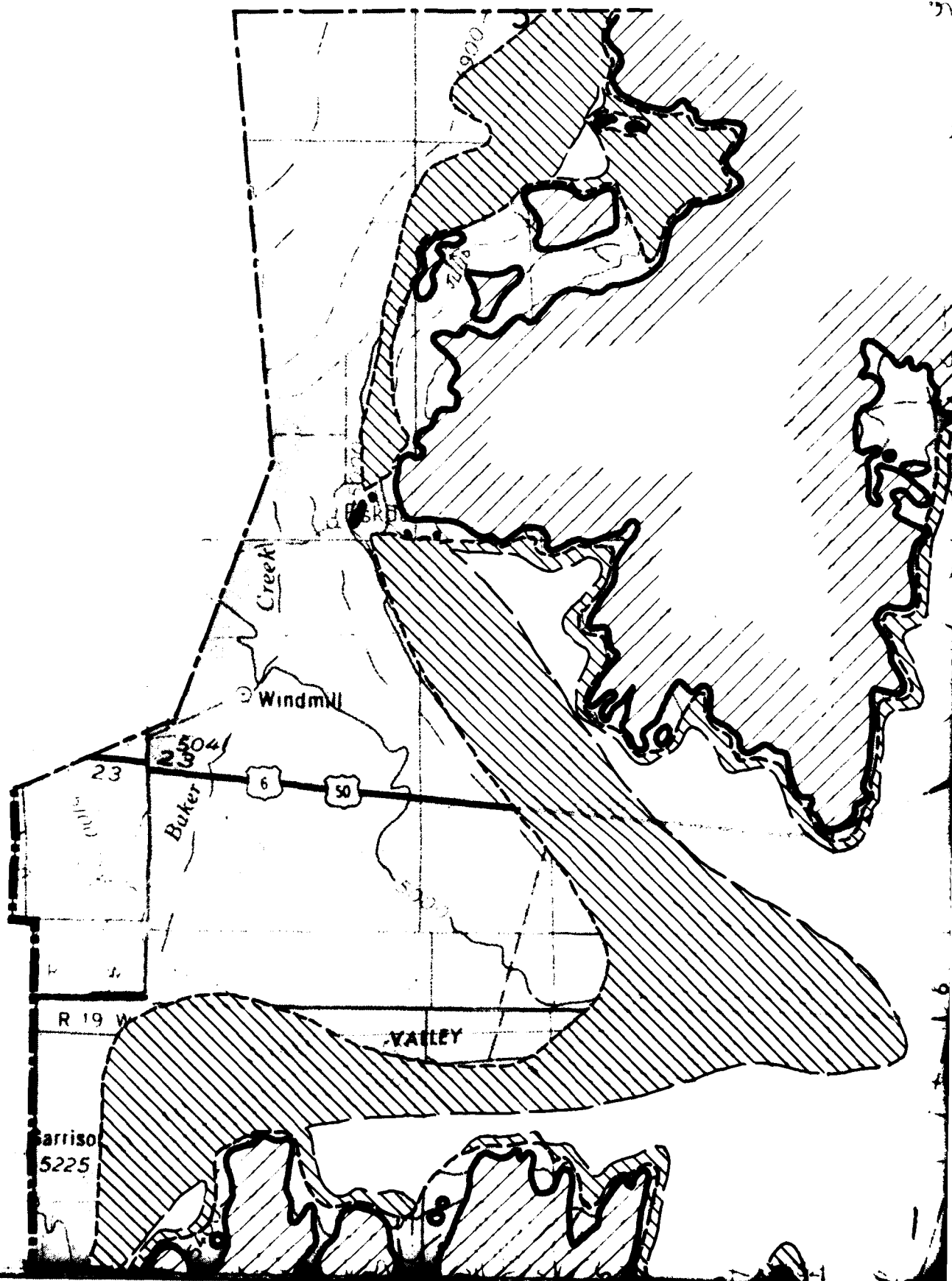
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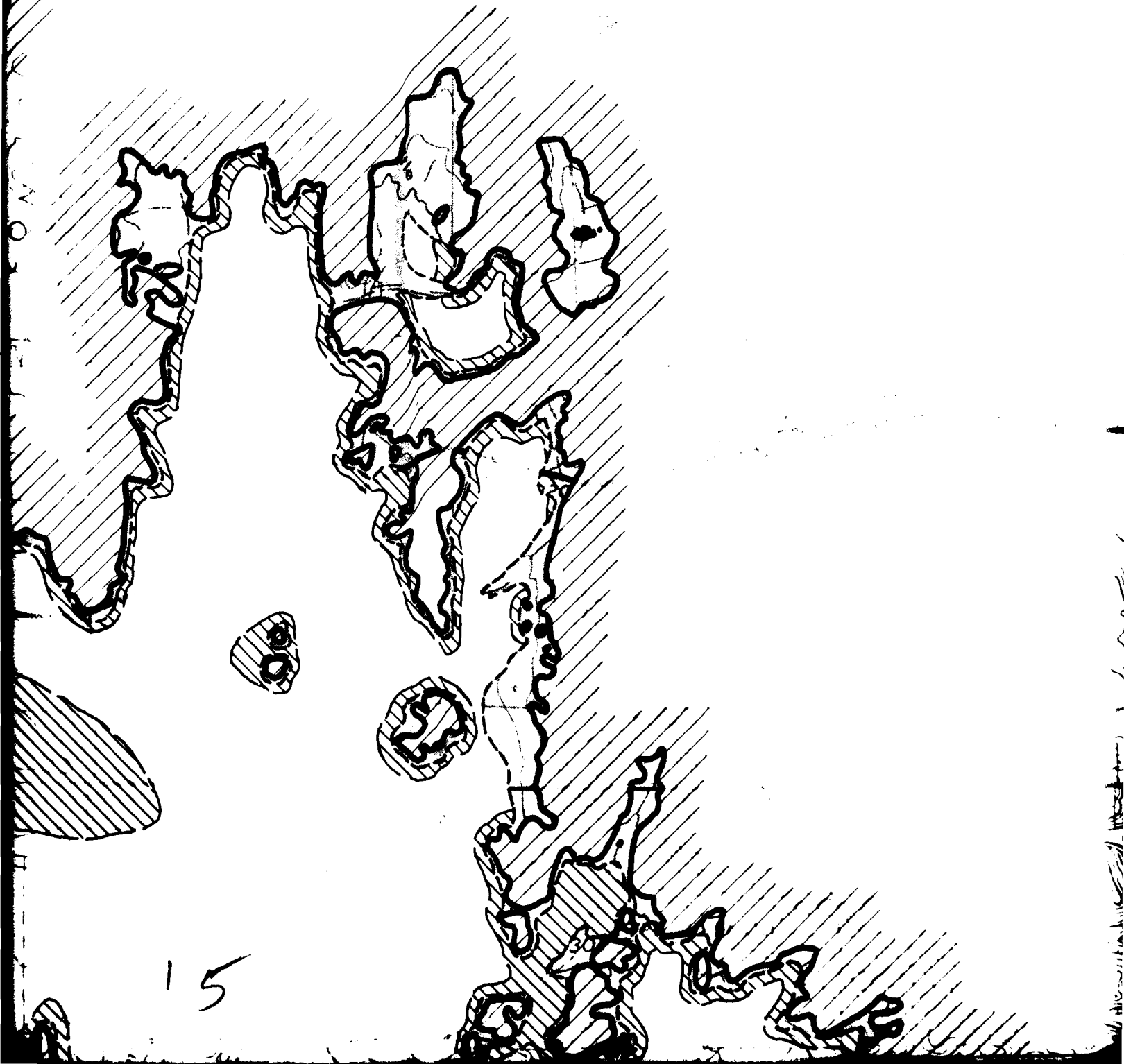
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RANGE

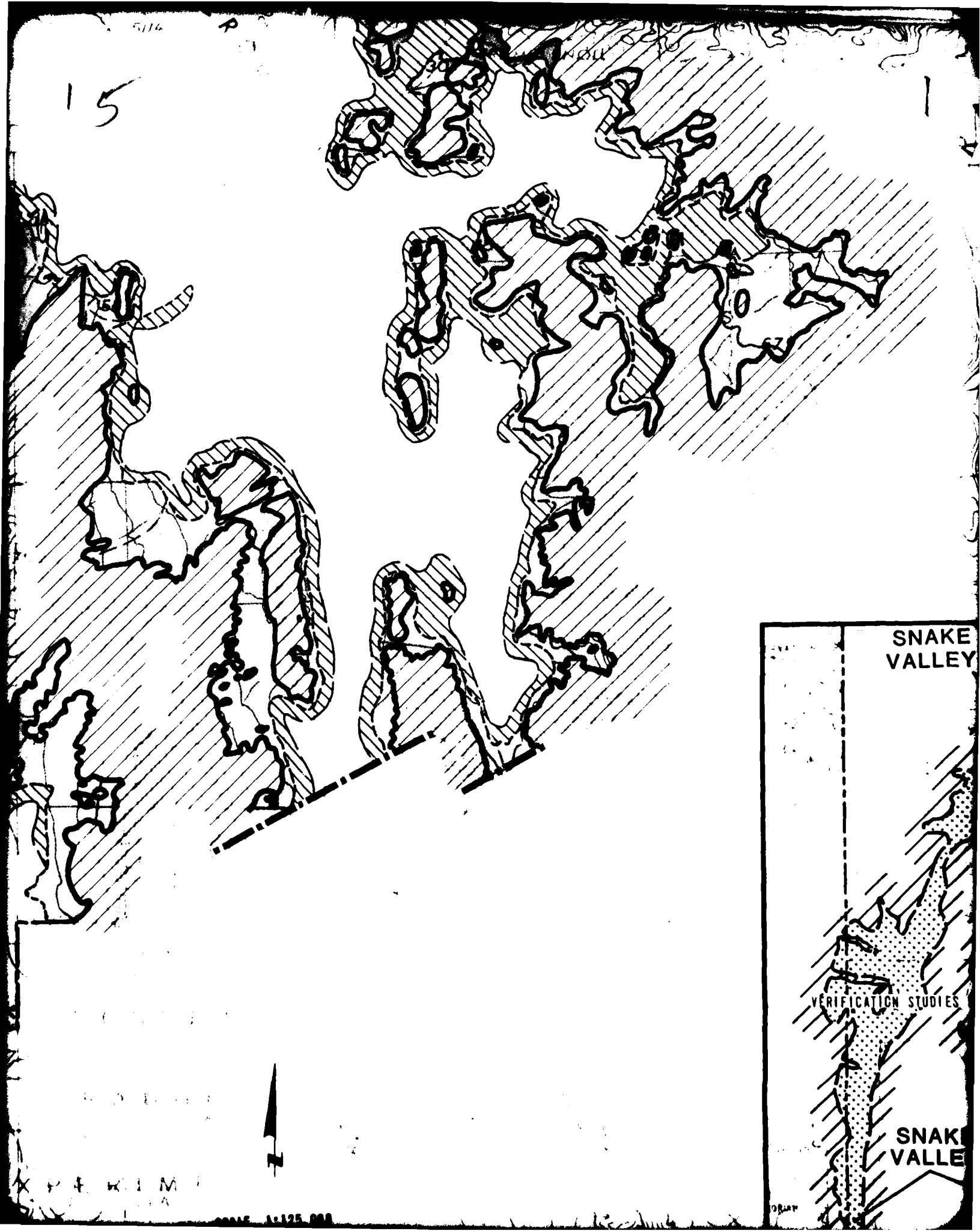
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15

1



SNAKE VALLEY

VERIFICATION STUDIES

SNAKE VALLEY

PERIMETER

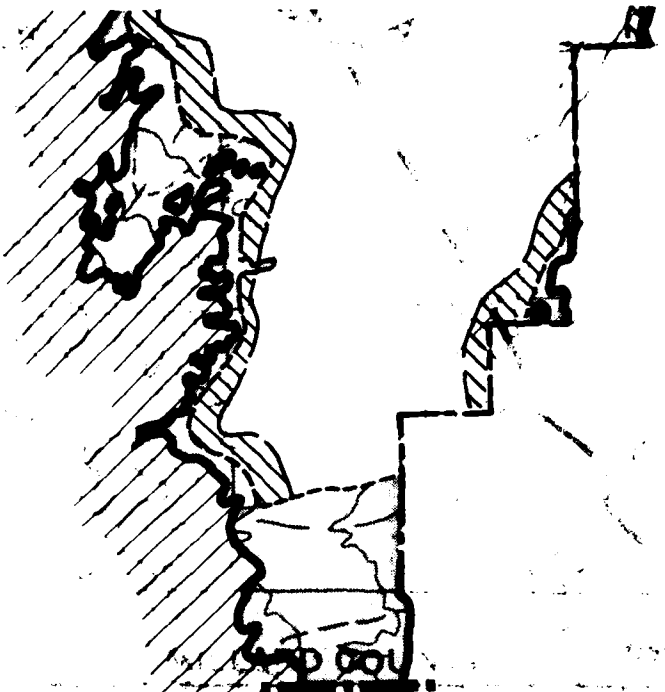
6

1

SNAKE
VALLEY

VERIFICATION STUDIES IN PROGRESS

SNAKE
VALLEY



NEVADA COUNTY

SUITABLE AREA
SNAKE VALLEY, NEVADA-UTAH

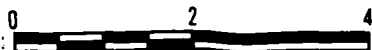
MR. SILLING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMD

DRAWING
3-4

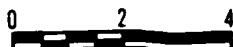
FUGRO NATIONAL, INC.

7

SCALE 1:125,000










STATUTE MILES



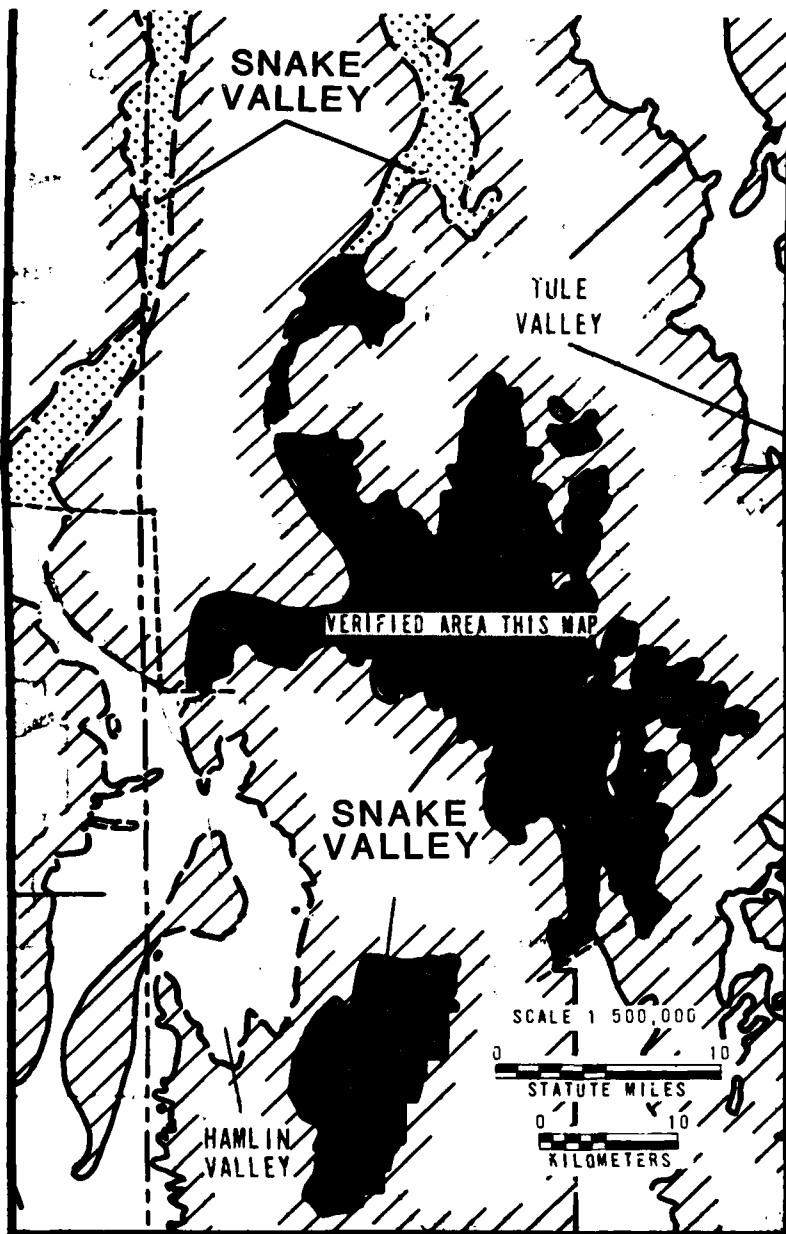
KILOMETERS

EXPLANATION

-  Area suitable for horizontal and vertical shelter basing modes. Depth to rock and or water greater than 150 feet (46m).
-  Area suitable for horizontal shelter but not suitable for vertical shelter. Depth to rock and or water greater than 50 feet (15m) and less than 150 feet (46m).
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-  Areas of exposed rock
-  Contact between rock and basin fill.
-  Limit of study for this report, including cultural boundaries (National Forest, DoD land, etc.).
-  Geographic limit of verification valley.



18



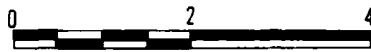
19

2 JUL 80

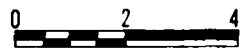
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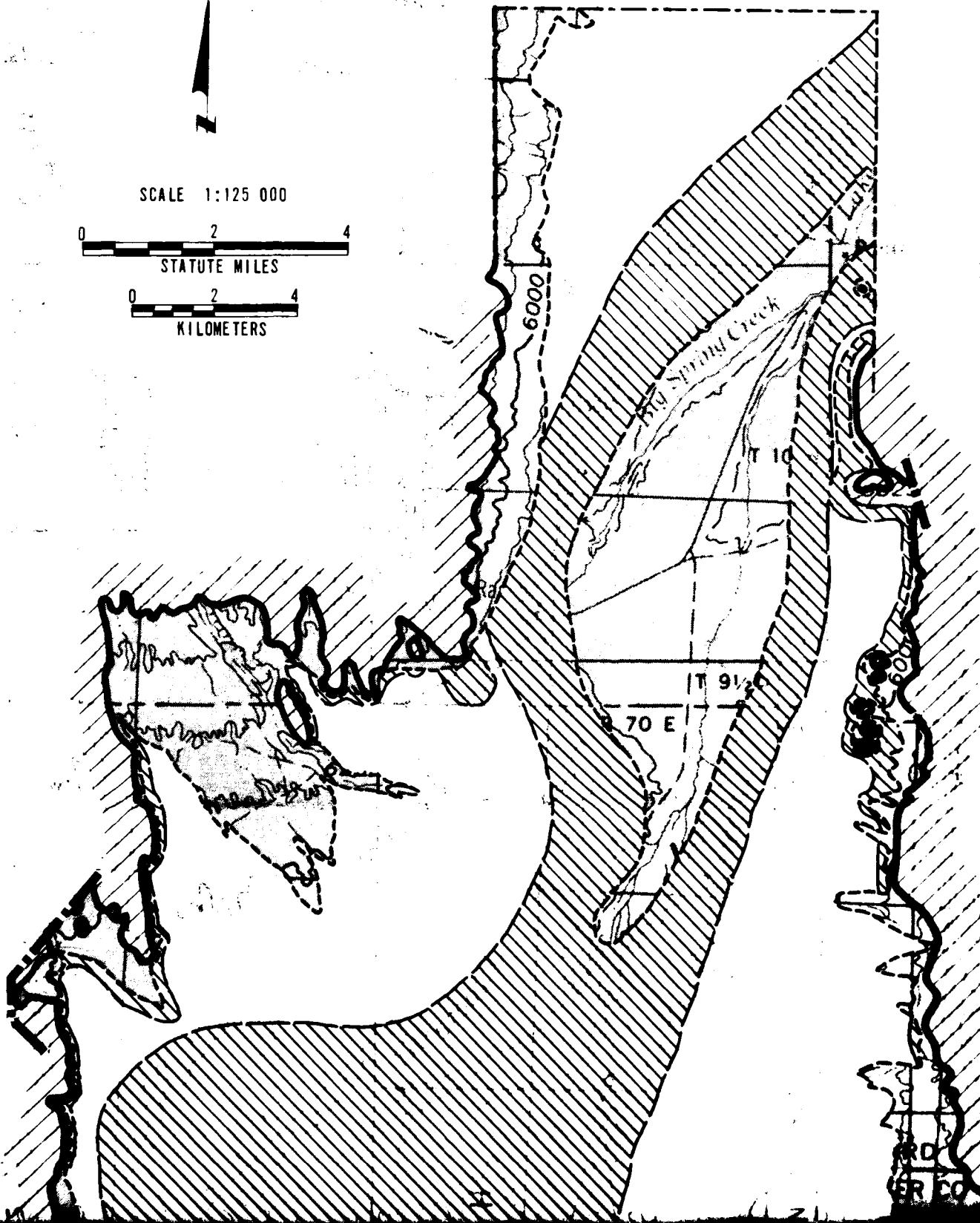
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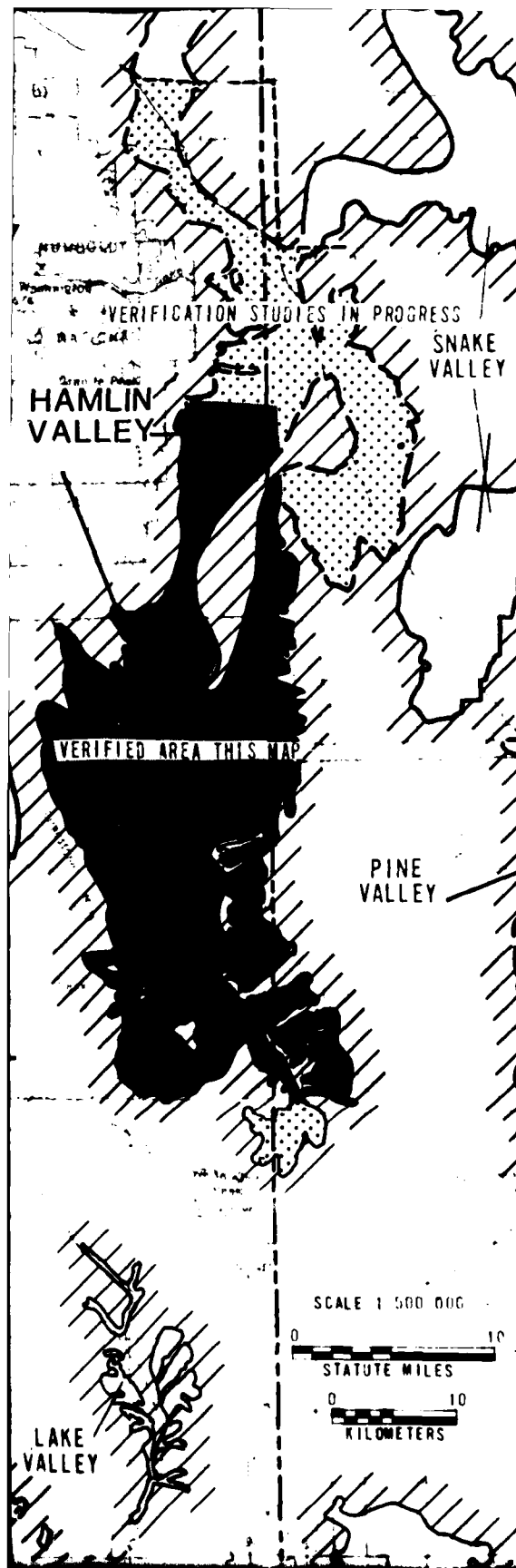
STATUTE MILES



KILOMETERS



43



37



SUITABLE AREA
HAMLIN VALLEY, NEVADA

VI SITING INVESTIGATION
DEPARTMENT OF THE AIR FORCE BMD








3-5

DRAWING

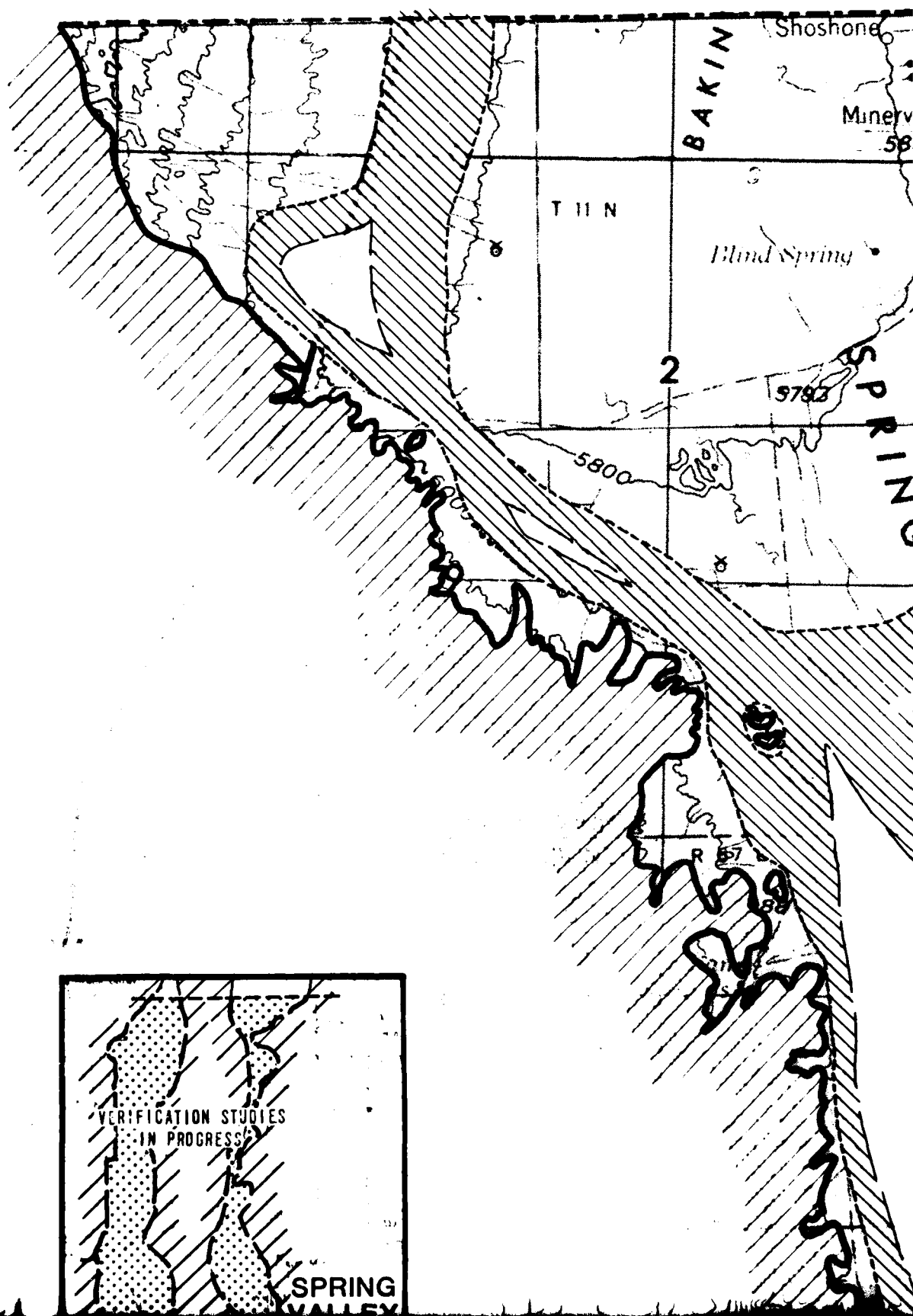
FLUORO NATIONAL, INC.

HAMLIN
VALLEY

EXPLANATION

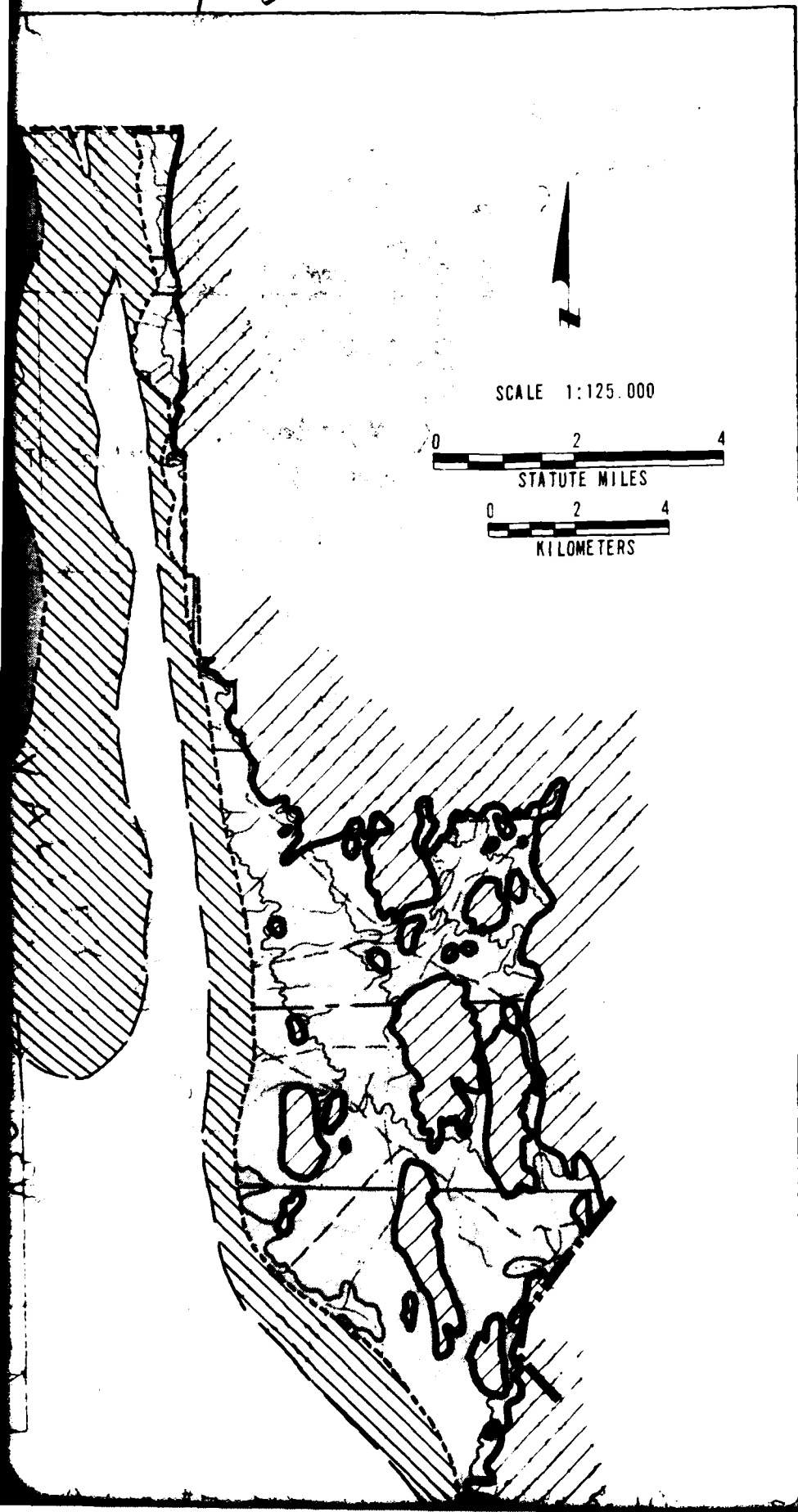
-  Area suitable for horizontal and vertical shelter basing modes. Depth to rock and or water greater than 150 feet (46m).
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-  Areas of exposed rock.
-  Contact between rock and basin fill.
-  Limit of study for this report, including cultural boundaries (National Forest, DoD land, etc.).
-  Geographic limit of verification valley

2 JUL 80

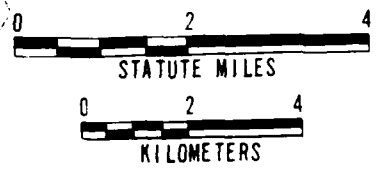


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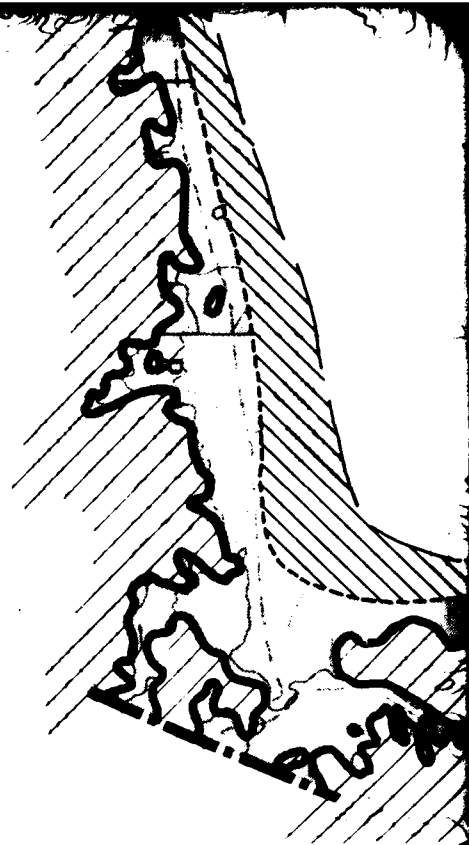
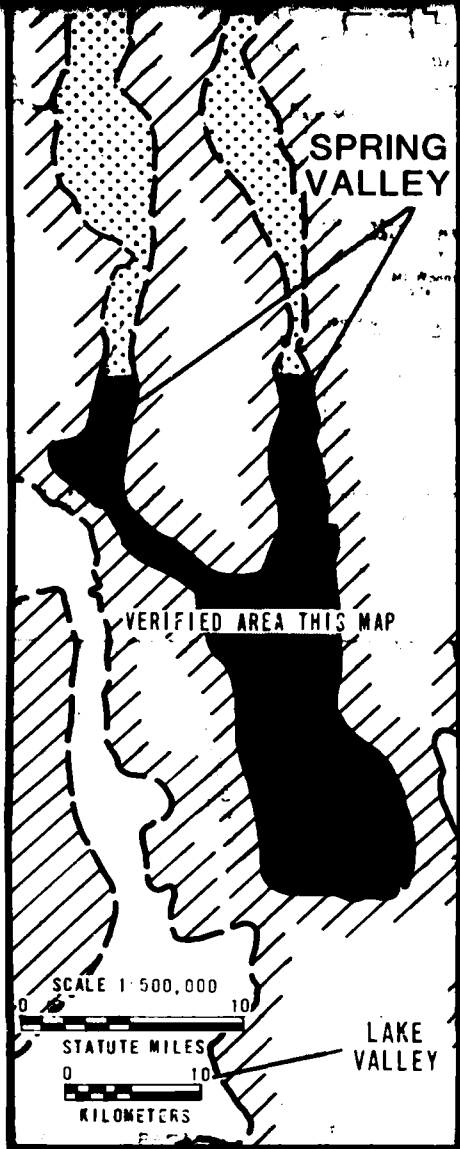
IN-IR-39-I



SCALE 1:125,000



31



EXPLAN

- Area suitable for horizontal basing modes. Depth to rock greater than 150 feet (46m).
- Area suitable for horizontal basing modes for vertical shelter. Depth to rock greater than 50 feet (15m).
- Area unsuitable for both horizontal and vertical basing modes as determined by rock and/or water, topographic exclusions.
- Areas of exposed rock.
- Contact between rock and basing modes.
- Limit of study for this report (National Forest boundaries).
- Geographic limit of verification.

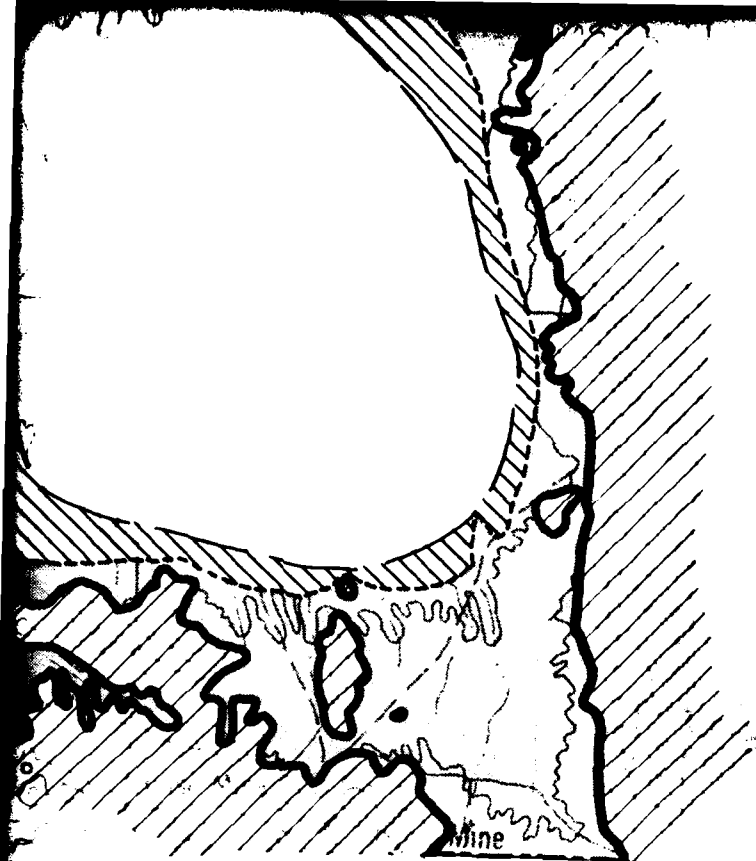
U.S. NATIONAL INSTITUTE OF AERONAUTICS AND SPACE

RESEARCH AND DEVELOPMENT DIVISION

WRIGHT-PATTERSON AIR FORCE BASE, OHIO

3-6

3-6



4

EXPLANATION

horizontal and vertical shelter
Depth to rock and/or water greater
(46m).

horizontal shelter but not suitable
shelter. Depth to rock and/or water
feet (15m) and less than 150 feet (46m).

for both horizontal and vertical shelter
determined from application of depth to
er, topographic terrain, and cultural

rock.

rock and basin fill.

for this report, including cultural
(ional Forest, DoD land, etc.).

of verification valley.

DATE
ILMEI